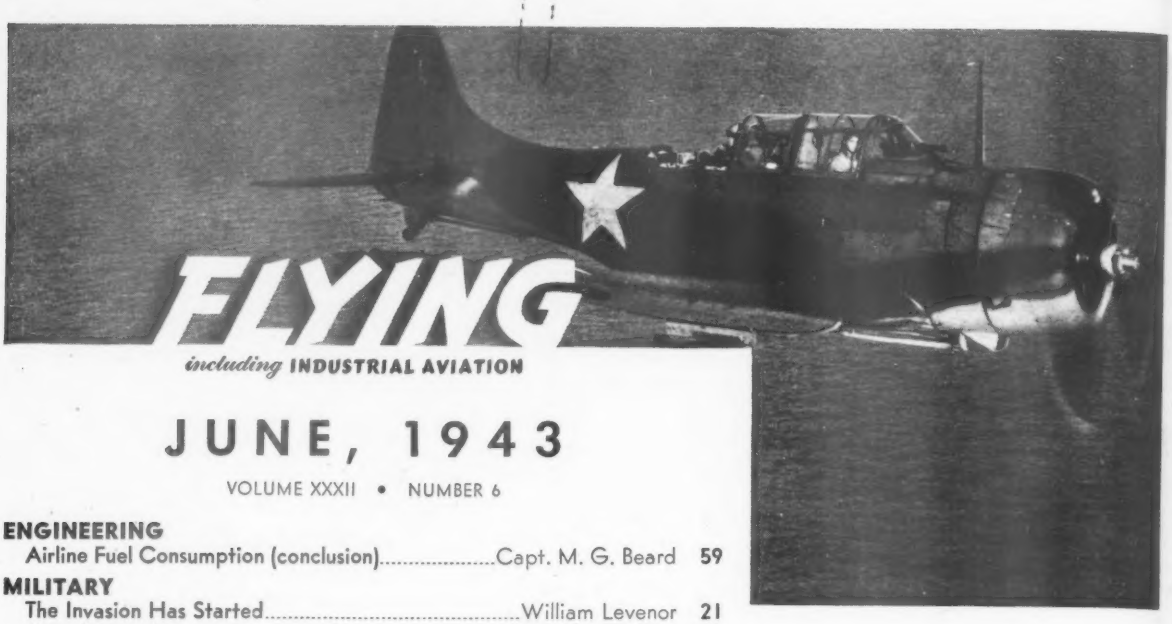


FLYING

including INDUSTRIAL AVIATION

JUNE, 1943

VOLUME XXXII • NUMBER 6

ENGINEERING
Airline Fuel Consumption (conclusion) ..... Capt. M. G. Beard 59

MILITARY
The Invasion Has Started ..... William Levenor 21
Assault on Africa ..... Fred Tupper, Jr. 31
London Survey ..... E. Colston Shepherd 37
Attack-Fighter 43
Riding the 'Lightning' ..... Paul Pierce 44
How to Beat the Japs in China ..... Maj. H. S. Mazet 48
Fast Flyers ..... James Montagnes 72
Natal Base ..... Henry W. Bagley 86

COMMERCIAL
The Aerial Watch on America's Food ..... S. R. Winters 46

TRAINING
The Fundamentals of Air Fighting 24
Scrapped Veterans ..... C. Budd Dugan 40
Aircraft Recognition Hints ..... Sq. Ldr. S. W. Gardner 60
'Patter' ..... John R. Hoyt 80
Wash Ride ..... Lieut. Richard Ryan 88

MAINTENANCE
The WAMS ..... Idell D. Hays 38

PRODUCTION
Plastic Planes ..... William Winter 34

PRIVATE FLYING
Have You Been Grounded? ..... Sedley Peck 68

PERSONALITY
From L-3 to P-47 ..... Lew Tansky 74

TRANSPORTATION
Bush Flying—Modernized ..... Bruce Keith 28

WASHINGTON
Report from Washington ..... L. Welch Pogue 42

DEPARTMENTS
At Deadline 8
Color Section 51
For Identification 61
Have You Seen? 64
I Learned About Flying from That!—No. 46 ..... W. F. Bettwy 66
The Library 85
Industrial Aviation 103
Air Services Section 119
Fifteen Years Ago 138
AOPA News 148
Letters 150

Cover Photograph: North American "Texan," by North American Aviation

WILLIAM B. ZIFF
Editor and Publisher

B. G. DAVIS
General Manager

MICHAEL H. FROELICH
Assistant to the Publisher

MAX KARANT
Managing Editor

DON RYAN MOCKLER
Associate Editor

HERMAN R. BOLLIN
Art Director

GEORGE BERNER
Advertising Manager

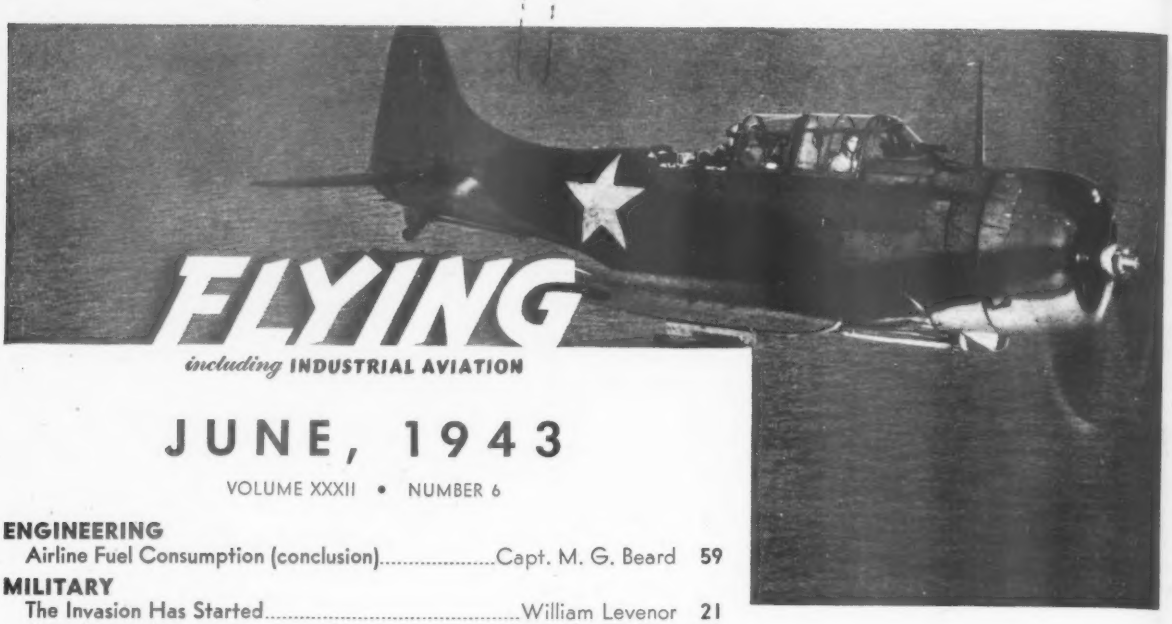
H. G. STRONG
Circulation Director

Copyright, 1943
ZIFF-DAVIS PUBLISHING COMPANY

Editorial Offices: 540 N. Michigan Ave., Chicago, Ill.
Member of the Audit Bureau of Circulations

★ ★ ★ ★ ★

FLYING is published monthly by Ziff-Davis Publishing Company at 540 N. Michigan Ave., Chicago, Ill. New York Advertising Office, 270 Madison Ave. West Coast Advertising Representative, William L. Pinney, 416 W. Eighth St., Los Angeles, Cal. Canadian Advertising Representative, G. J. McGoey, 21 King Street, East, Toronto. London Advertising Representative, J. Forecast, Edwin Greenwood, Ltd., 231 Strand, London W.C.2. London editorial representative, A. Spenser Allberry. Washington Office, Earle Building. Special Washington representative, Lieut. Col. Harold E. Hartney, Occidental Hotel. Leo Kieran, eastern editorial representative, Earle Building, Washington, D.C. SUBSCRIPTION RATES: In U. S., $3.00 per year, single copies 25 cents; in South and Central America and U. S. Possessions, $3.00 per year; in Canada, $3.50 per year, single copies 30 cents; in British Empire, $4.00 per year. All other foreign countries, $6.00 per year. Subscribers should allow two weeks for change of address. Address all subscription letters to the Director of Circulation, FLYING, 540 N. Michigan Ave., Chicago. Entered as second class matter, September 8, 1942, at the Post Office, Chicago, Illinois, under the act of March 3, 1879. Entered as second class matter at the Post Office Department, Ottawa, Canada. Contributors should retain copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever adaptations and revisions are necessary to meet requirements. Payment covers all authors', contributors' and contestants' rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of material purchased.



FLYING

including INDUSTRIAL AVIATION

JUNE, 1943

VOLUME XXXII • NUMBER 6

ENGINEERING
Airline Fuel Consumption (conclusion) ..... Capt. M. G. Beard 59

MILITARY
The Invasion Has Started ..... William Levenor 21
Assault on Africa ..... Fred Tupper, Jr. 31
London Survey ..... E. Colston Shepherd 37
Attack-Fighter 43
Riding the 'Lightning' ..... Paul Pierce 44
How to Beat the Japs in China ..... Maj. H. S. Mazet 48
Fast Flyers ..... James Montagnes 72
Natal Base ..... Henry W. Bagley 86

COMMERCIAL
The Aerial Watch on America's Food ..... S. R. Winters 46

TRAINING
The Fundamentals of Air Fighting 24
Scrapped Veterans ..... C. Budd Dugan 40
Aircraft Recognition Hints ..... Sq. Ldr. S. W. Gardner 60
'Patter' ..... John R. Hoyt 80
Wash Ride ..... Lieut. Richard Ryan 88

MAINTENANCE
The WAMS ..... Idell D. Hays 38

PRODUCTION
Plastic Planes ..... William Winter 34

PRIVATE FLYING
Have You Been Grounded? ..... Sedley Peck 68

PERSONALITY
From L-3 to P-47 ..... Lew Tansky 74

TRANSPORTATION
Bush Flying—Modernized ..... Bruce Keith 28

WASHINGTON
Report from Washington ..... L. Welch Pogue 42

DEPARTMENTS
At Deadline 8
Color Section 51
For Identification 61
Have You Seen? 64
I Learned About Flying from That!—No. 46 ..... W. F. Bettwy 66
The Library 85
Industrial Aviation 103
Air Services Section 119
Fifteen Years Ago 138
AOPA News 148
Letters 150

Cover Photograph: North American "Texan," by North American Aviation

WILLIAM B. ZIFF
Editor and Publisher

B. G. DAVIS
General Manager

MICHAEL H. FROELICH
Assistant to the Publisher

MAX KARANT
Managing Editor

DON RYAN MOCKLER
Associate Editor

HERMAN R. BOLLIN
Art Director

GEORGE BERNER
Advertising Manager

H. G. STRONG
Circulation Director

Copyright, 1943
ZIFF-DAVIS PUBLISHING COMPANY

Editorial Offices: 540 N. Michigan Ave., Chicago, Ill.
Member of the Audit Bureau of Circulations

★ ★ ★ ★ ★

FLYING is published monthly by Ziff-Davis Publishing Company at 540 N. Michigan Ave., Chicago, Ill. New York Advertising Office, 270 Madison Ave. West Coast Advertising Representative, William L. Pinney, 416 W. Eighth St., Los Angeles, Cal. Canadian Advertising Representative, G. J. McGoey, 21 King Street, East, Toronto. London Advertising Representative, J. Forecast, Edwin Greenwood, Ltd., 231 Strand, London W.C.2. London editorial representative, A. Spenser Allberry. Washington Office, Earle Building. Special Washington representative, Lieut. Col. Harold E. Hartney, Occidental Hotel. Leo Kieran, eastern editorial representative, Earle Building, Washington, D.C. SUBSCRIPTION RATES: In U. S., $3.00 per year, single copies 25 cents; in South and Central America and U. S. Possessions, $3.00 per year; in Canada, $3.50 per year, single copies 30 cents; in British Empire, $4.00 per year. All other foreign countries, $6.00 per year. Subscribers should allow two weeks for change of address. Address all subscription letters to the Director of Circulation, FLYING, 540 N. Michigan Ave., Chicago. Entered as second class matter, September 8, 1942, at the Post Office, Chicago, Illinois, under the act of March 3, 1879. Entered as second class matter at the Post Office Department, Ottawa, Canada. Contributors should retain copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever adaptations and revisions are necessary to meet requirements. Payment covers all authors', contributors' and contestants' rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of material purchased.

17, THE IMPORTANT STEP

If you want the AIR FORCE you must train for it..and before it is too late!

Never before in the history of our nation has reaching the age of 17 been so important. At that age, whether you realize it or not, you MUST make a vital decision . . . whether you will prepare yourself for maximum service to our war effort and for opportunities for rapid advancement or whether you will continue your normal routine and let fate run its course.

DON'T MAKE THE MISTAKE OF DELAYING. True patriotism is more than idly waiting to be called. If a man is able to make himself more valuable to our war effort, IT IS HIS PATRIOTIC DUTY TO DO SO. You at 17 are most fortunate and have the opportunity of a life-time. YOU STILL HAVE TIME FOR TRAINING.

Enlistments were closed so that each man can be placed in the particular branch of service for which he is best qualified. The regular army needs you badly even without technical training, but if you want The Air Force you must train for it . . . and before it is too late!

Established in 1929, Curtiss-Wright Technical Institute has trained thousands for aviation and since 1939 has been training Army Air Force Mechanics. WE KNOW HOW! But pre-induction plus broad career training is available to you only as a civilian. By obtaining this training you prepare yourself not only for maximum service to our war effort but also equip yourself for a fascinating and profitable lifetime career in the most promising industry of the future..... American Aviation.

Curtiss-Wright Technical Institute, located in the very center of Southern California's giant aircraft industry, is one of the oldest, best known, largest and most distinguished aeronautical schools in the nation. Its high standing in the Aircraft Industry is sharply indicated by the fact that Mr. Donald Douglas, President of the great Douglas Aircraft Company, chose this school for his own son's training. Our thousands of successful graduates have proven that Curtiss-Wright Technical Institute Training gets results. IT CAN DO THE SAME FOR YOU.

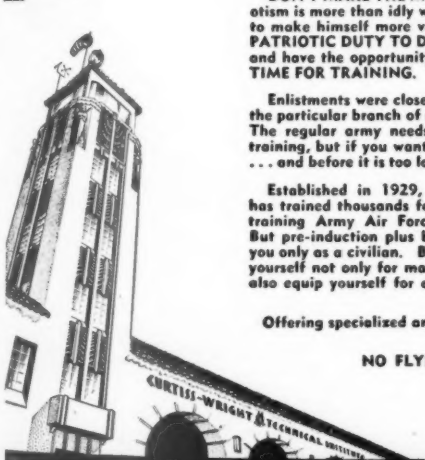
THE FUTURE FOR ONE TRAINED IN AVIATION CAN BE ALMOST WITHOUT LIMIT. BUT REMEMBER . . . get this training before you are 18. Time is often all too short. IT WILL NOT WAIT.

SEND COUPON NOW . . . including your birthdate.

NOTE TO PARENTS . . . If your son is approaching the selective service age he's probably more eager to "get into the scrap" than you realize. Give him a chance to get this finest pre-induction training. It may be important to him; and to you!

Offering specialized and proven training in AERONAUTICAL ENGINEERING AND MASTER AVIATION MECHANICS

NO FLYING INVOLVED



THIS TOWER OVERLOOKS AVIATION'S MOST DISTINGUISHED SCHOOL OF AERONAUTICS

CURTISS WRIGHT TECHNICAL INSTITUTE

GRAND CENTRAL AIR TERMINAL, 1225 AIRWAY, GLENDALE (LOS ANGELES) CALIF.
UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY, OWNER, SINCE ITS ESTABLISHMENT IN 1929

Contractor to the U. S. Army Air Corps

BE WISE—PROTECT YOUR FUTURE

MAIL TODAY • DON'T DELAY

WITHOUT COST OR OBLIGATION SEND ME FULL INFORMATION AND CATALOG ON THE COURSE CHECKED BELOW

- ☐ AERONAUTICAL ENGINEERING COURSE
- ☐ MASTER AVIATION MECHANIC COURSE
- ☐ SPECIALIZED ENGINE COURSE
- ☐ SPECIALIZED AIRPLANE COURSE
- ☐ POST GRADUATE AERONAUTICAL ENGINEERING COURSE
- ☐ SPECIALIZED AIRCRAFT SHEET METAL COURSE
- ☐ AERONAUTICAL DRAFTING COURSE, HOME STUDY
- ☐ AIRCRAFT BLUE PRINT READING COURSE, HOME STUDY

NAME

ADDRESS

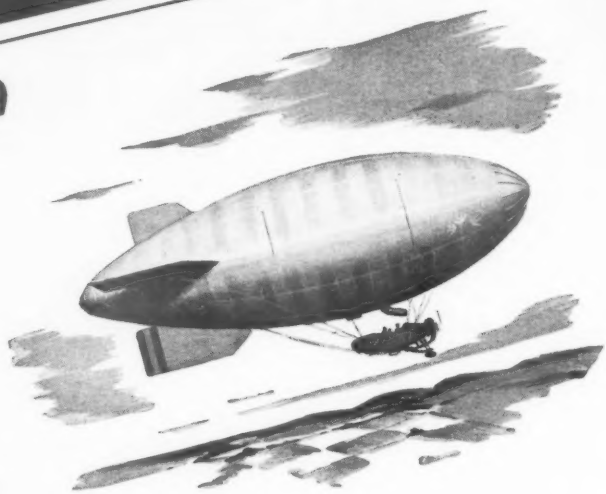
CITY STATE

DATE OF BIRTH FA-6

JOIN THE U. S. AIR FORCES

Trail Blazing in the Skies

1919

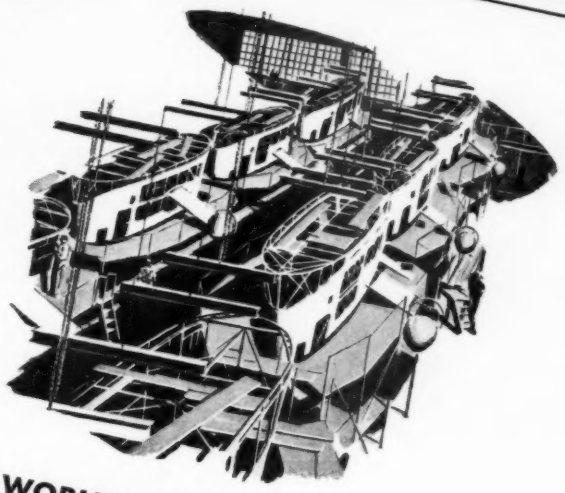


THE PIONEER COMMERCIAL AIRSHIP in the United States was the "Pony Blimp," built by Goodyear in 1919 to demonstrate the possibilities of small lighter-than-air craft. Based at Los Angeles, it ferried passengers to Catalina, located and mapped deep-sea fishing grounds and was frequently employed in photographic work. This small ship of only 35,000 cubic-foot capacity provided much engineering and aeronautical knowledge that was later incorporated in the famous Goodyear blimp fleet.

HOW GOODYEAR AIRCRAFT CORPORATION SERVES IN AERONAUTICS

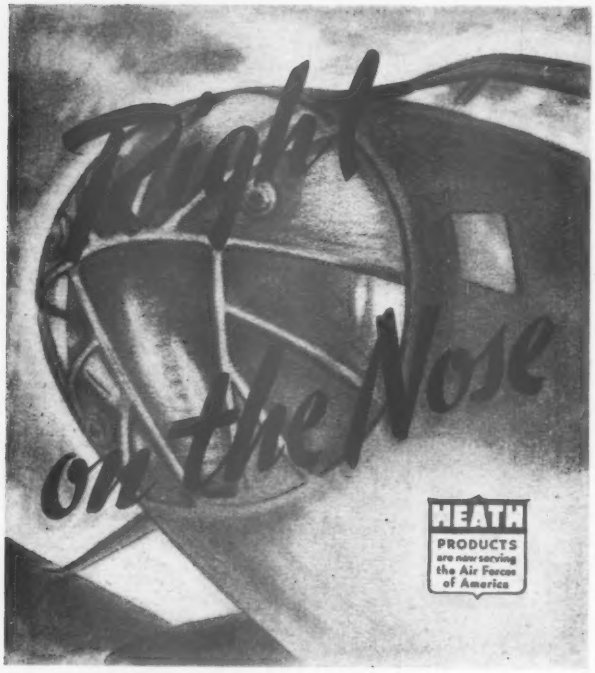
1. *By building parts to manufacturers' specifications.*
2. *By designing parts for all types of planes.*
3. *By re-engineering parts for mass production.*
4. *By extending our research facilities to aid the solution of any design or construction problem.*
5. *By building airships and airplanes for the government.*

1943



THE WORLD'S FIRST AIRSHIP ASSEMBLY LINE is operated today by Goodyear in building large submarine-patrol airships for the U. S. Navy. Here, by continuous mass-production methods, squadrons of sky cruisers are being speeded out in rapidly increasing numbers—the largest, fastest, farthest-ranging non-rigids the U. S. Navy has ever used. This high-speed construction is made possible only by Goodyear's quarter-century experience in airship fabrication — a "know how" that is proving invaluable today in guarding this nation's sea lanes.

GOODYEAR
AIRCRAFT

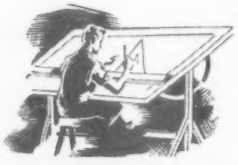


and *Right* anywhere because it's HEATH Formed Plastic

HEATH "Lifetime" Plastic Windshield

Popularly called "The Material Of Tomorrow," plastic in sheet form has long since been used by aviation pioneers such as HEATH. For the past four years Heath has been supplying the aviation industry with plastic windshields and enclosures and is equipped to form and fabricate sheet plastics of acetates, Plexiglas and vinyl resins . . . Selecting the proper plastic for your requirement is important. Heath's knowledge of plastics for aircraft use is backed by years of research, experiment and experience. We have manufacturing facilities available for the forming and fabrication of aircraft plastic units. Your inquiry is invited.

We are contractors for formed plastic aircraft parts. Prompt consideration given to war contract requirements. Write today.



★ MANUFACTURERS OF AIRCRAFT COMPONENTS ★

HEATH

BENTON HARBOR Company ★ MICHIGAN, U.S.A.

AT DEADLINE

by MAX KARANT

ANOTHER pet theory of the experts has been scuttled. It's been a bromide for some time that "land-based, level bombers are ineffectual against naval surface vessels." Like the bumblebee that hadn't been told that it's aerodynamically impossible for something of its size and structure to fly, General MacArthur's Army pilots—and the Australians and Dutch—went ahead and did it anyway. The Bismarck Sea, and later episodes, have blown the theorists out of the water once again. For what the Army bombers did to those Jap convoys will go down in history.

It has always been that way. Remember some of the more widely-known condemnations? At one time or another every one of our Army's fighting planes was next-to-useless. Our heavy bombers were just overdone airliners that could only carry a few cream puffs, compared to the British giants. Our bombsight was a joke. The dive bomber was just a gadget. And, of course, the Army's level bomber wasn't worth a poached egg against naval ships.

Every single such theory set up so far has been shot to pieces when it came time to prove it. Our "no-good" fighters are knocking the enemy to ribbons. Our heavy bombers fly higher, faster and carry greater loads (payload is 10 tons on the *Flying Fortress*, as compared to the eight tons of the British Avro *Lancaster*). The bombsight unquestionably has come up to the expectations of its Army Air Forces champions. The dive bomber has proved an extremely deadly weapon. As to the level bomber versus naval vessels, well, the recent South Pacific episodes are just the latest proof that our military aviation people might possibly, by some remote stretch of the imagination, have known what they were doing all along.

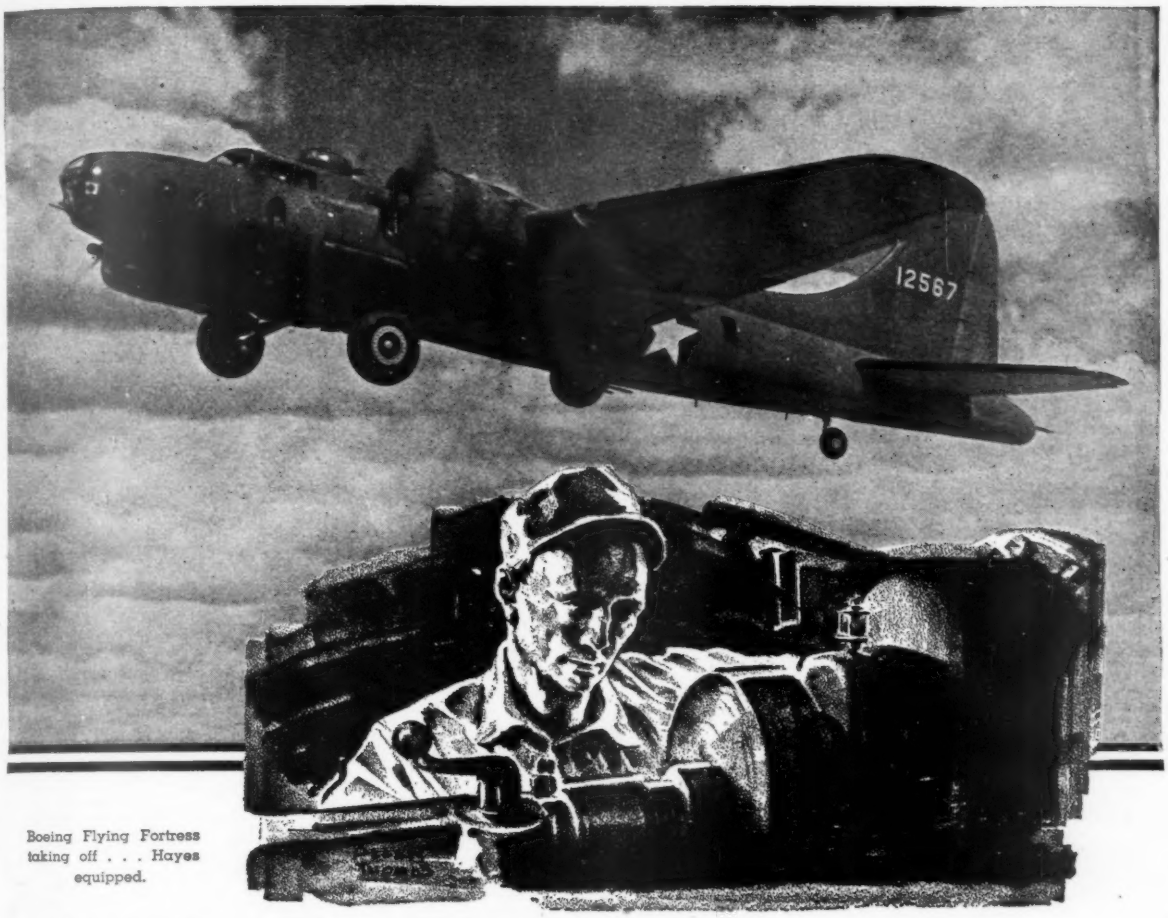
* * *

AN interesting commentary on American aircraft—and further proof that our aircraft manufacturers are turning out some of the world's finest planes—is the attitude of British aviation officials. Sir Roy Fedden, recently returned to England from an extensive tour of the American aviation industry, openly admitted that our *Flying Fortresses* have the greatest load-carrying capacity in the world. Military security has, for some time, kept us from publishing that fact—which is all the more impressive when you consider that our bombers carry that bomb load in addition to (for the *Fortress*) 13 .50 caliber machine guns. The *Lancaster* carries only 10 .30 caliber guns and a smaller bomb load, and it should be emphasized that there is a tremendous difference between the two groups of armament.

There are several other British admissions of American superiority. As Mr. Shepherd frankly admits in his article on page 37 of this issue, British air transport is depending almost entirely on American-built aircraft. The Fleet Air Arm of Britain's Royal Navy appears to have adopted U.S. Navy aircraft wherever possible. At the present time, the Fleet Air Arm is using Grumman *Wildcats* and *Avengers*, as well as the *Kingfisher* and Curtiss *Seagull*. While hundreds of *Catalinas*, *Liberators*, *Kittyhawks* and *Warhawks*, *Bostons*, *Havocs*, *Hudsons*, *Venturas*, *Baltimores*, *Marauders*, *Mitchells*, and *Mustangs* are officially admitted to be in wide use by the RAF (excluding cargo, liaison and other utility types), many of our newer types appear to be slated for the RAF. In an aircraft recognition handbook dated September, 1942, in London, the following American aircraft are listed as "American Monoplanes with the RAF": Consolidated *Coronado*, Lockheed *Lightning*, Martin *Mariner* and Republic *Thunderbolt*. It has not yet been officially announced that these last four are being flown in combat by the RAF.

With surprisingly few exceptions, nearly every type of combat aircraft in the U. S. Navy and Army Air Forces also is being widely used in the RAF or Fleet Air Arm. What better tribute could there be to our aviation industry?

(*Continued on page* 177)



Boeing Flying Fortress taking off . . . Hayes equipped.

MAYBE IT'S YOUR KID WE'RE WORKING FOR . . .

On the world's war fronts—the work of our hands and brains and machines is in ACTION—in the hands of our forces.

Who knows who "they" may be? Maybe a son, a husband, father, brother or kin of ours. OR YOURS! That front line today reaches into every home and factory of America—and by ties of blood and duty, we're **all** working for THEM!

As evening comes on—it will be daylight of tomorrow out in the South Pacific . . . and it'll be dark in Africa and Europe.

But don't let it be dark for them because we ever let them down at home.

And don't let a day dawn on them with the helplessness of empty-handed rage because SOMEONE failed back where FIGHTING PRODUCTION begins. It takes more than guts to fight this war, the way it's being shot at our boys. It takes everything they can get their hands on—planes and tanks, guns and ships and shells and bombs, and all that goes with them.

Let America's war workers be able to say, "Okay, son—we're in there pitching for you every minute. Give it to 'em your own way, kid!—We'll back you up!"

—The men and women of Hayes Industries.

Representatives: *Western . . . Airsupply Co., 5959 W. 3rd St., Los Angeles.*
Eastern . . . J. Henry Reisner, Hagerstown, Md.

HAYES AIRCRAFT WHEELS AND BRAKES . . .

HAYES INDUSTRIES, INC. Home Office: JACKSON, MICHIGAN, U. S. A.

The Birdmen's Perch

AIRCRAFT engine classes in the Army Air Corps are emphatically warned of the danger of careless handling of warn-out, sodium-filled exhaust valves.

We think that the warning should be passed on to you Perch Pilots who do your own repair work.

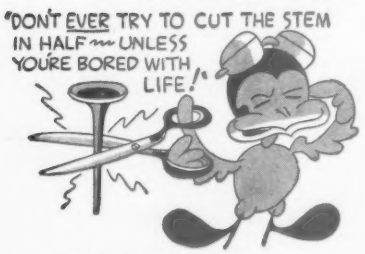
A worn-out, sodium-filled exhaust valve is as dangerous as a bomb and should be handled like one! Dump such valves into deep water or bury them underground . . . never include them in a scrap pile!

When sodium is heated, it turns first into a liquid, then into a gas. And both changes are accompanied by a considerable expansion. Melting the valve in a scrap furnace would release the compressed vapor in a thoroughly nasty explosion.

See?

Major Al Williams,

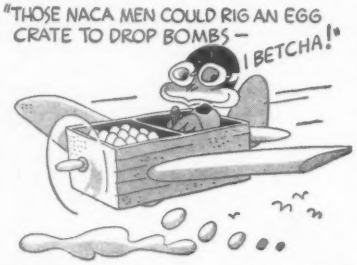
alias, "Tattered Wing Tips," Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.



SUPER-RESEARCH BY SUPER-EXPERTS

Ever hear of the NACA?

That's the National Advisory Council on Aeronautics and we doubt if this country has a single combat plane which doesn't owe some of its performance to this group. A manufacturer can build a plane which seems to be the absolute ultimate in plane design and seems to deliver the absolute maximum of performance. But the super-experts at the



NACA labs invariably are able to add extra miles per hour to the plane's speed; extra pounds to its payload.

We mentioned the NACA because its work so closely parallels the work done in Gulf's Laboratories.

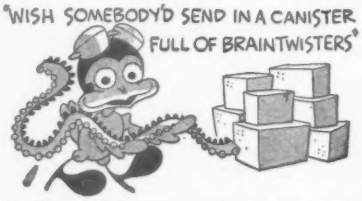
We had an airplane-engine lubricant that we thought was the absolute ultimate in lubrication. We thought it delivered the absolute maximum of performance because it was refined from the best crudes obtainable by the most up-to-date techniques known.

Then our specialists popped up with a refining method called the Alchlor Process. This method began where our previous refining procedure ended — and got *extra* carbon-formers, *extra* sludge-makers out of an already highly refined oil.

We call this lubricant "Gulfpride"— and you'll see why we're proud of it when you use it!

BRAINTWISTER

The crews of 3 bombers must divide 21 canisters of ammunition so that each



bomber will have 7 canisters. But only 7 of the canisters are full; 7 are half full; 7 are empty. How can the canisters be divided so that each bomber has the same number of canisters and the same number of rounds of ammunition.

This problem's so easy that there are *two* answers! We'll send them both to you for a postcard. The address is right over there in the first column.

ANOTHER PETROLEUM WAR-PRODUCT

A torpedo has a "mind"—a series of tiny engines of watch-like delicacy—which can direct it to:

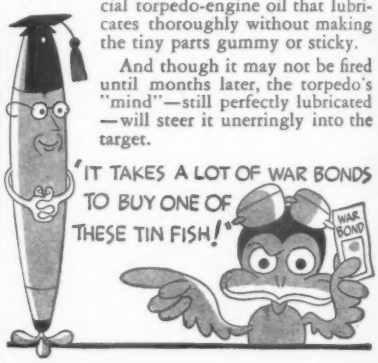
—travel deceptively in the wrong direction, suddenly change course and head straight for the target . . .

—vary its depth to pass cleanly under a friendly boat before hitting a target on the other side . . .

—obligingly sink after a miss to prevent becoming a navigational hazard.

If one of the torpedo's more than 1300 parts misfunctions, the tin fish may miss (at $16,000 a miss!) or even circle and hit the ship that fires it! These things seldom happen though, *because of oil.* For the mechanical brain of the torpedo is lubricated with a special torpedo-engine oil that lubricates thoroughly without making the tiny parts gummy or sticky.

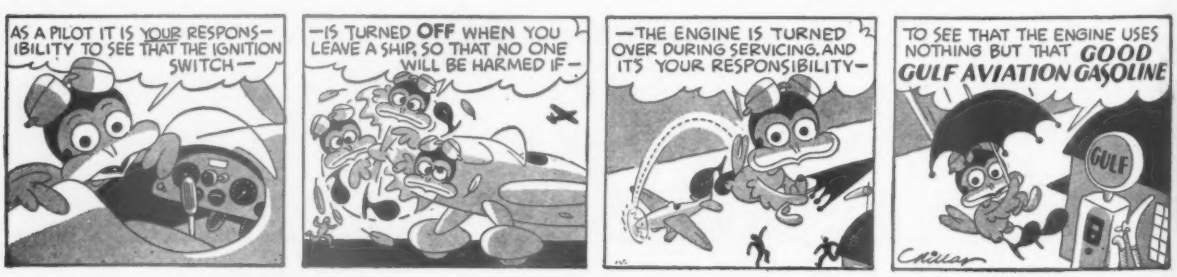
And though it may not be fired until months later, the torpedo's "mind"—still perfectly lubricated—will steer it unerringly into the target.



Gulf Oil Corporation and Gulf Refining Company... makers of

GULF AVIATION PRODUCTS

OIL IS AMMUNITION—USE IT WISELY


AS A PILOT IT IS YOUR RESPONSIBILITY TO SEE THAT THE IGNITION SWITCH—
—IS TURNED OFF WHEN YOU LEAVE A SHIP, SO THAT NO ONE WILL BE HARMED IF—
—THE ENGINE IS TURNED OVER DURING SERVICING, AND IT'S YOUR RESPONSIBILITY—
TO SEE THAT THE ENGINE USES NOTHING BUT THAT GOOD GULF AVIATION GASOLINE
GULF

KEEPING AMERICA OUT IN FRONT
THE growing strength of our fighting forces everywhere is a tribute to the supreme effort of America's aviation industry. Aircraft production has surpassed the most daring forecasts. Today, huge air fleets range world-wide routes, speeding delivery of vital war cargo. The increasing power of our air armada is being recorded on every front.
As contractor to the United Army and Navy, Spartan is proud to have a part in aviation's history-making achievements. Out of Spartan's war-time activities will come valuable lessons and experiences which will be incorporated in Spartan aircraft of the future.
SPARTAN AIRCRAFT Co.
TULSA, OKLAHOMA
BUILDERS OF FINE AIRCRAFT SINCE 1929
CONTRACTOR TO THE U. S. ARMY AND U. S. NAVY
SPARTAN SCHOOL OF AERONAUTICS
This "University of Aviation," operated as a division of the Spartan Aircraft Company, is serving a fighting America by training the vital *manpower for victory*. Spartan School graduates are serving the aviation industry in all parts of the world.

This advertisement is one of a series which will appear in national magazines and newspapers this year as Consolidated's contribution toward a clearer public understanding of "aviation geography."

CONSOLIDATED VULTEE AIRCRAFT

No Spot on Earth is More Than 60 Hours From Your Local Airport

ALONG with all that's being said and written about the kind of world we'll be living in after the war, here's one fact you cannot ignore:

"No spot on earth today, however distant, is more than 60 hours' flying time from your local airport!"

MERCATOR PROJECTION

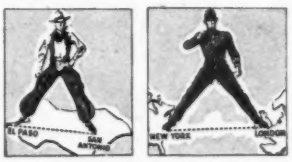
If a Liberator bomber, *built in San Diego, were crated and shipped the 9240 miles to Algiers by sea, it would arrive about a month later.*

POLAR AZIMUTHAL EQUIDISTANT PROJECTION

A Liberator *is capable of flying the 6210-mile airline route from San Diego to Algiers in about 31 hours' flying time.*

If you doubt it, ask the pilots and crews who are flying today's big, long-range planes, ferrying military personnel and supplies to our far-flung battle fronts. They'll tell you that the Atlantic is only 400 minutes wide—that Australia and San Francisco are a mere 35 hours' flying time apart—that you can hop from the U. S., touch Brazil's hump, and come down in Africa, all in 27 hours' flying time.

Or look at one of the new "aviation geography" maps, like those our children are studying in school. These maps make obsolete the maps we have always known. They show us the world as it really is. In this world, because of the plane, Main Street runs from your home town to London, Moscow, and Chungking. Nations and people we once thought remote are now merely hours and minutes away.



From El Paso, Texas, *to San Antonio, Texas, is 617 miles—an 18-hour trip by train.*

The Airline Route *from New York to London is 3460 miles—a 17-hour flight.*

Today, of course, the global skyways are reserved for war. But after the war, when freedom of the air returns, trade and travel by plane will become as much a part of everyday life as the use of cars, trucks, busses, railroads, and ocean liners. It is no dream of the future to count on global transportation in giant planes which fly almost with the speed of sound itself. Even today, such planes are being designed and are undergoing their wind-tunnel tests.

The Air Age has come, sooner than we thought. Already we have had to learn that wars must be won with the *aid* of the new Air-Age geography—not in spite of it. And we are beginning to see that the peace we win must be built on a clear understanding of this new global geography and how it can work *for* us.

AIR-AGE TIMETABLE

FROM	TO	AIRLINE MILES	HOURS
New York	Berlin	3960	28
Chicago	Singapore	9385	47
New York	Capetown	7001	38
San Francisco	Wellington	6759	34
Washington	Moscow	4883	24
London	Rome	887	4½
New York	London	3460	17
London	Berlin	574	3

The tens of thousands of men and women who make up the U.S. aircraft industry believe that America must be supreme in the air—to win the war today, to win the peace tomorrow.

They know that air power alone will not win the war. But they find it difficult to imagine a nation, which possesses the *finest* planes, and the *most* planes, going down to defeat.

• • •

Consolidated Vultee Aircraft Corporation

San Diego, Cal. · Vultee Field, Cal. · Fort Worth, Texas · New Orleans, La. · Nashville, Tenn. · Wayne, Mich. · Allentown, Pa. · Tucson, Ariz. · Elizabeth City, N. C. · Louisville, Ky. · Miami, Fla.

Member, Aircraft War Production Council

★ ★ ★ ★ ★ ★

QUICK FACTS FOR AIR-MINDED READERS

Consolidated Vultee builds the 4-engine, long-range Liberator bomber, the huge Coronado, (33-ton, 4-engine Navy patrol bomber), the Catalina, (famous twin-motored Navy patrol bomber), and the Liberator Express, (4-engine transport version of the Liberator bomber).

• • •

In addition to the "big ones," Consolidated Vultee also builds the VALIANT, (basic military training plane), the VENGEANCE, (dive bomber), the SENTINEL, (liaison observation plane known as the "Flying Jeep"), and the RELIANT, (navigational trainer).

• • •

"... today we are flying as much lend-lease material into China as ever traversed the Burma Road, flying it over mountains 17,000 feet high, flying blind through sleet and snow." *From the President's address to Congress, Jan. 7, 1943.*

• • •

Major General "Jimmy" Doolittle was the first American aviator ever to take off, fly, and land "blind". He did it in 1929, piloting a Consolidated training plane known as the NY-2 Husky.

• • •

At the Consolidated Vultee plant in San Diego, there are testing laboratories in which the temperature is maintained at 80 degrees below zero.

• • •

One of Consolidated Vultee's test pilots has to his credit over 20,225 hours in the air. His total flying time equals more than 852 full days, or two and one third years of continuous flying time.

• • •

The U. S. Navy has just placed a $30,000,000 order for additional Catalina amphibian long-range patrol bombers which, when completed, will release for combat and convoy duty many U. S. Navy destroyers and other surface craft now engaged in patrol work.

LIBERATOR (4-engine bomber) — CORONADO, CATALINA, and P4Y (patrol bombers) — LIBERATOR EXPRESS (transport) — VALIANT (basic trainer) — VENGEANCE (dive bomber) — SENTINEL ("Flying Jeep") — RELIANT (navigational trainer)

CUTTING THE PATTERN FOR VICTORY

Here is one of many production fronts.....At Solar, continuous schedules are maintained to produce Exhaust Systems for the trainers, fighters, bombers and cargo planes of the United States. Our fighting forces can be assured that Industry at home is "Cutting the Pattern for Victory".

ARMY E NAVY

SOLAR

EXHAUST SYSTEMS—

SOLAR AIRCRAFT COMPANY * SAN DIEGO, CALIFORNIA

COMMANDOS of the Assembly Line...

Speed Nuts they're tough!

SPEED NUTS are truly the commandos of the assembly lines. They are tough — and fast in action.They are now being rushed into aircraft factories where they are vitally needed on the assembly lines.

Spring Steel SPEED NUTS are approved by the U. S. Army Air Forces and the Bureau of Aeronautics for most all non-structural attachments. Conversion to the use of Speed Nuts on all approved applications releases critical bar stock steel for other important uses.

Our Engineering Dept. will be glad to assist you in determining the proper approved locations where SPEED NUTS may be used. Request for information or assistance will receive immediate attention.

AIRCRAFT KEEP 'EM FLYING

TINNERMAN PRODUCTS INC.
2086 FULTON ROAD, CLEVELAND, OHIO

IN CANADA:
Wallace Barnes Co., Ltd., Hamilton, Ontario

IN ENGLAND
Simmonds Aerocessories, Ltd., London

Speed Nuts THE FASTEST THING IN FASTENINGS! Speed Clips

PHOTO BY HARRIS & EWING

HERE IS THE MOST IMPORTANT "PUBLIC" FOR YOUR PUBLIC RELATIONS MESSAGES

and you reach it best through The Washington Post

Do you use public relations advertising to tell of your company's part in the war effort?

Who needs to be sold on the accomplishments of American industry more than official Washington?

Do you use public relations advertising to explain your company's peculiar problems?

Who needs to know of these problems—who holds the power to solve them—more than official Washington?

Do you use public relations advertising to instruct and encourage the public, to help build morale?

Who needs to be made aware of this co-operation from American business more than official Washington?

The most important people in America are those now working in the White House, in the Capitol, in the great marble and limestone buildings that house the executive departments, in the headquarters of the Army and Navy.

It is essential for the success of your public relations program that you impress these Washington officials with your message. You can best do this by placing your public relations advertising in The Washington Post.

The Washington Post is read by practically every important government official and ranking Army and Navy officer in Washington. Recent surveys show that The Post is read regularly by the President and his aides, by 98% of the heads of the war agencies, by 86% of all War Production Board executives, by 87% of the Senate, by 100% of the Cabinet.

No other medium in America can give you this type of coverage and penetration! Yet you can buy advertising in The Washington Post for only $732 a full newspaper page—a campaign of 12 full pages will cost you less than $8,800.

The Washington Post

EUGENE MEYER, EDITOR AND PUBLISHER

Represented by Osborn, Scolaro, Meeker & Co. in New York, Detroit, Chicago, and St. Louis, and by George D. Close, Inc., on the Pacific Coast.

Joe Smith of Plainville Knows

RYAN BUILDS WELL!

"JOE SMITH" typifies Americans in action on the production front. Joe knows he has far more than a job to hold down—he has a war to win. At Ryan he's learned that to win he must build well—and fast! Whether the product of Joe's craftsmanship is a Ryan airplane, an exhaust system or a major sub-assembly, he knows it must not, cannot fail his brothers-in-arms on the fighting fronts.

Tomorrow's Airplane Can Be Yours
Bought With Today's War Bonds

AT WAR'S END no one doubts the vital role of aviation in building the peace. Then, in a hundred "Plainvilles" every Joe Smith who can will be flying as owner or passenger in Ryan planes, because "during the war" Americans everywhere learned that Ryan Builds Well.

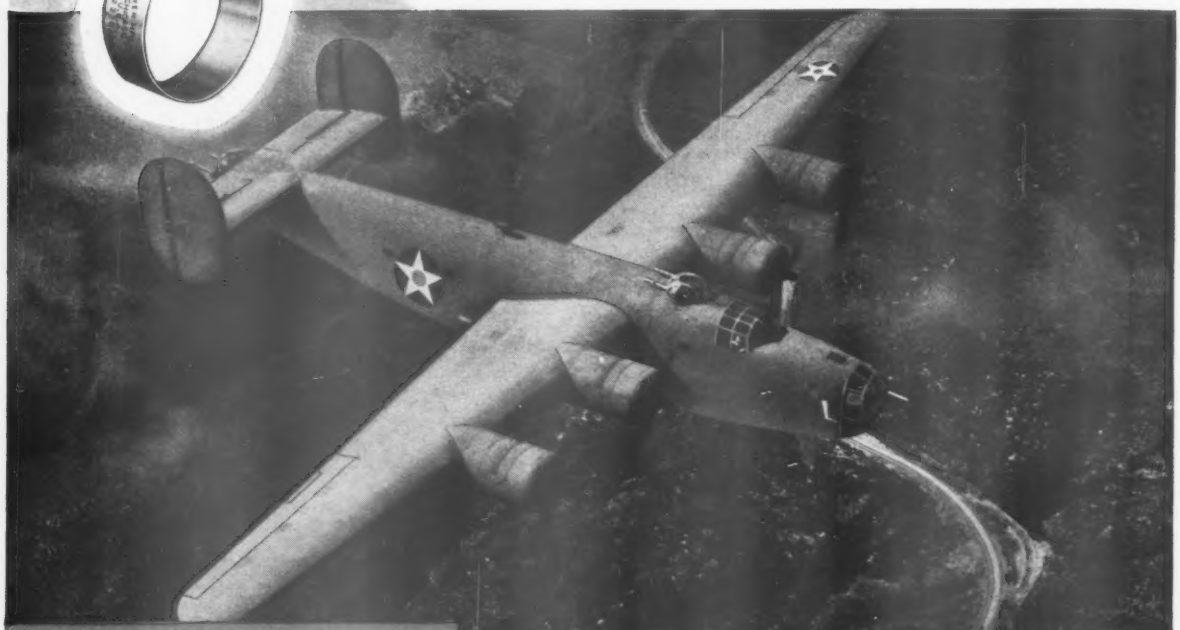
Rely on **Ryan** TO BUILD WELL

RYAN AERONAUTICAL COMPANY, San Diego, Calif. — **Member, Aircraft War Production Council, Inc.**

Ryan Products: Army PT-22s, Navy NR-1s, Army PT-25s, Major Sub-Assemblies and Exhaust Manifold Systems for America's Most Distinguished Aircraft

Outstanding in Performance!

Yet—made of noncritical steel

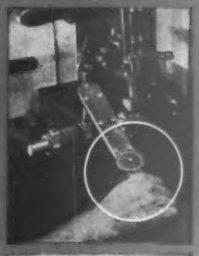


Consolidated B-24 Liberator equipped with Wittek Aviation Hose Clamps

Exceeds

LEAK TEST REQUIREMENTS

Two Wittek Type FBCA Hose Clamps installed on 1-inch I.D. hose to a wrench torque of 20-inch lbs. Pressure applied inside the hose is 210 lbs. per square inch *without leakage.*



Exceeds

WRENCH TORQUE REQUIREMENTS

Wittek Type FBCA Hose Clamp installed on hose to a wrench torque of 118 lbs. *without failure* to any parts.

Exceeds

STRENGTH REQUIREMENTS

Wittek Type FBCA Hose Clamp being load tested without hose. Load imposed on the Clamp is 2970 lbs. *without failure.*

All tests conducted as outlined in Army Specifications 25529, April 16, 1942

Wittek Types FBC and FBCA Aviation Hose Clamps

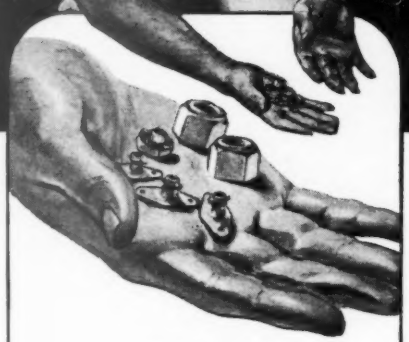
Made of noncritical mild carbon steel, and zinc plated for corrosion resistance, Wittek Types FBC and FBCA Aviation Hose Clamps have performance characteristics comparable to hose clamps that were made of stainless steel.

Wittek Aviation Hose Clamps, known as the standard of the industry since the beginning of modern aviation, are now being used by the nation's leading military aircraft and engine builders. Wittek FBCA Hose Clamps meet all requirements of Army Air Forces Specification 25529. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago

...Buy War Bonds...

ARMY E NAVY

WITTEK Aviation HOSE CLAMPS



They Save Millions of Pounds of Precious Metal

Stamped from sheet metal, Boots Self-Locking Nuts make it possible for American planes to fly over a million pounds lighter. In addition to this saving in weight, due to lightness of the nut, Boots are responsible for another, even greater saving: planes made in part of plywood and plastics, thus saving tons of strategic metal, are now fabricated with the new Boots "Cage" Nut. This unique fastening device also operates upon the famous Boots seif-locking principle.

SEVEN-LEAGUE BOOTS, 1943 STYLE

Carrier based planes, like those above, wear Boots All-Metal, Self-Locking Nuts. Because Boots Nuts are so much *lighter* than other nuts, our naval aircraft can carry extra gallons of precious fuel which increases the Navy's striking power by hundreds of miles.

The lightness of Boots Nuts can also mean extra firepower for the planes which wear them. But lightness isn't the whole story. Boots Nuts are durable—literally "outlast the plane." No plane vibration can loosen them. They can be re-used time and time again. Boots All-Metal, Self-Locking Nuts, used on every type of U. S. plane, meet the exacting specifications of all government agencies.

A recent addition to the Boots family is the new, all-metal "Rol-Top" nut. It is specially designed for engine application, and has gained wide acceptance among manufacturers in that field.

BOOTS

Self-Locking Nuts For Application In All Industries

BOOTS AIRCRAFT NUT CORPORATION ★ GENERAL OFFICES, NEW CANAAN, CONNECTICUT

No. 3
OF A SERIES

Beechcrafts at work

The AT-7 Beechcraft two-engine Navigational Trainer, shown below, serves the Army and Navy by providing a means of instructing pilots and navigators in the solution of the problems of long-distance flights. These airplanes are equipped with all of the devices used for modern celestial navigation, as well as for radio and dead-reckoning navigation, and provide accommodations for the training of three navigators simultaneously.

The AT-7 Beechcrafts combine high cruising speed, long range, and excellent flight and landing characteristics. They thus permit long flights, by day and by night, to distant points without the imposition of any abnormal burden on the skill of their pilots.

The use of the AT-7's as specialized Navigation Trainers is only one of the many examples of how the Army and Navy are providing their future combat pilots and navigators with the finest training in the entire world.

Beech Aircraft
CORPORATION

BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U. S. A.

The INVASION HAS STARTED!

British Information Services

Lighted by the flashes from antiaircraft and bomb bursts, this "Lancaster" was photographed over Hamburg.

by WILLIAM LEVENOR

☆

Bombed day and night, the enemy faces an increasing tempo of aerial assault as the Allied air forces form huge reserves of air power.

☆

THE continent of Europe is the target for today—and for every day and every night until Germany collapses. Is it the prelude to invasion? No, *it is the invasion itself.* True, no occupying force of Allied troops has yet seized continental territory from the Axis; but make no mistake about it—the invasion has started.

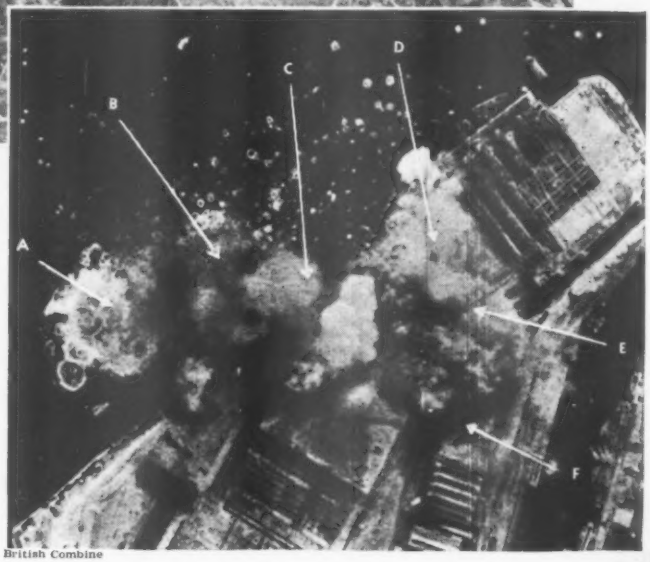
In the bombardment of the Axis citadel of Europe, the pace has been set by the fantastically destructive raids of the past winter and early spring. Now, the Royal Air Force and the U.S. Army Air Forces are hitting their stride and there will be no lessening of the punishment they mete out to Germany and the lands occupied by the Nazis.

To draw a comparison that is valid, for all its unpopularity among air enthusiasts, the present intensive bombing attacks on Europe have much the same relationship to the coming occupation by Allied forces as the artillery barrage to the advance of infantry in a ground action. The "softening up" barrage and the infantry advance, together form the "attack." So it is with the invasion of Europe—remorseless aerial bombardment is intended to soften up (and beyond question is softening up) the Axis-held continent in preparation for the final combined operation which will actually occupy territory.

That is not to say that the aerial bombardment is as narrowly restricted, either in range or immediate objective, as an ordinary artillery barrage—however stupendous the latter may be. It is a much more extensive operation and does what field artillery has been unable to do effectively—it strikes at the very vitals of

U.S. Army—British Combine

"Flying Fortresses" streak for home following a raid on Lorient U-boat pens. Aerial close-up (right) shows bombed objectives (a) camouflaged floating docks, (b) southern tip of floating dock, (c) submarine entrance, (d) northern floating dock tip, (e) buildings, (f) building near basin.



British Combine

the enemy far behind the "front" lines, smashing his industries, wrecking his transportation, ruining his communications and, if not shattering the home morale, certainly in the long run building up such an accumulation of discomfort, fatigue and distress that the results are an inevitable drag on his war potential.

What is the pattern of the bombardment? Large-scale area bombing by the RAF in night operations; heavy daylight precision attacks by increasingly large forces of U.S. *Flying Fortresses* and *Liberators*, both accompanied by lighter attacks carried out on separate objectives by smaller bombers. It is a round-the-clock business as often as the weather permits—and the weather will permit it more frequently through the late spring and the summer.

It is not as rigid as that may sound. The RAF bombs by day and the AAF will handle their share of night operations. But in general, each is doing the job it is best equipped and trained to do. Complete understanding exists between the two forces, and operational cooperation is in the offing—may, in fact, have become an actuality by the time this is printed.

Plans for this operational cooperation—closely coordinated day-and-night attacks, for instance, on the same target—already have been made. Maj. Gen. Ira C. Eaker, commanding the U.S. 8th Air Force, said in March that as soon as weather conditions remained favorable for 24 hours, the *Fortresses* and *Liberators* would go out by day to light up a fat target for that night's RAF operations. Or, the Americans will go out for a precision cleanup job by day on a target the RAF has softened up the night before.

This cooperation, wherever and however discussed, inevitably brings to the fore the AAF's established method of daylight, precision bombing of specific objectives, which has been freely criticized by many writers who favor the massive "area bombing" technique in night operations. It has been said repeatedly that the American method, developed for defense of Caribbean and Pacific outposts, is not suitable for western Europe.

In general, these criticisms can be reduced to three generalizations: (1)—In daylight operations, losses from enemy fighter attacks become prohibitively high beyond the range of fighter escorts; (2)—on long flights into the interior Germany, the bomb loads of the *Liberator* and *Fortress* are too small to justify the operations [The Boeing company recently released an approved statement to the effect that the payload (which undoubtedly consists largely of bombs) of the latest *Flying Fortresses*—not the newer, heavier bombers coming up—has been boosted to 10 tons. Assuming 4,000 pounds for crew, guns, fuel, etc., that would bring the *Fortresses'* bomb load well up to that of the touted Avro *Lancaster* of the RAF. An important point to be remembered in that connection is that the *Fortress* carries 13 .50 caliber machine guns, while the *Lancaster* carries only 10 .30 caliber guns—a tremendous difference in firepower.—Ed.]; (3)—precision, high-altitude bombing is practicable only in fine weather, which most of the time does not exist over western Europe.

General Eaker has answered the first

two emphatically and categorically: American bomber losses on daylight raids are proportionately no higher than RAF losses on night raids; hundreds of newer and bigger American bombers will soon be operating. On the weather factor, the answer is not so flat. Fog and mist obscure the target frequently, but successful daylight raids have been carried out despite this obstacle.

As an instance of this, it is necessary only to recall the first raid by American heavy bombers on Germany proper—the attack by both *Fortresses* and *Liberators* on Wilhelmshaven and Emden last January 27. Despite poor visibility, later reconnaissance photographs disclosed the operation was highly successful. Furthermore, the unescorted heavy bombers encountered "swarms" of enemy fighters, shot down a large number of them, but lost only three of their own number.

General Eaker is the authority for the assertion that high-altitude precision bombing of targets in Germany and Nazi-occupied Europe, with an economically low rate of losses, has been proved definitely feasible. The rate of losses, in fact, has been extraordinarily low. The RAF figures that its night bombings are profitable if the rate of loss is no more

(*Continued on page* 158)

Central Press

Fighter-escorted AAF "Liberators" struck at the Nazi installation in Dunkirk. Remarkably clear picture shows damage caused by bomb bursts on the northern section of port.

"Eager Beaver" will fly this one-ton bomb to Germany. Crew sets fuse and attaches fins.

U.S. Army—Acme

FUNDAMENTALS OF AIR FIGHTING

PUBLISHED BY SPECIAL PERMISSION OF THE WAR DEPARTMENT

A primer of air combat tactics is provided our fighter pilots. The text has been taken from official U.S. communiques.

Sketches are from the official booklet; large drawings are by FLYING art staff, based on the originals.

The information that follows has been derived from official and accurate reports of actual air combats and operations. Much of what is repeated here is as old as air fighting itself. The information portrayed is disseminated not as inflexible rules or directives, but rather imparts something of what has been learned of air operations thus far and to encourage initiative and study of the subjects covered by all flying personnel. The air fighter must be constantly awake to all developments, be ever alert to use his best talents to meet the ever fast moving panorama of air warfare. To anticipate future developments one must have some knowledge of past and present methods.

GUNNERY PRINCIPLES

IN air combat, the purpose of the fighter pilot and flexible gunners is to destroy the enemy quickly with the minimum amount of ammunition. This can best be accomplished by developing superior firepower, and firing at decisive range, which depend on:

Accuracy of gun sighting,
Number and type of guns and amount of ammunition available,
Correct estimation of range,
Concentration of firepower.

Concentration of firepower may be considered in two parts, viz: Concentration of fire in time and space depending upon the number of guns that can be brought to bear either from a single aircraft or from a formation; bullet density built up during fire, depending on time and range.

The area of space covered by the fire from a single gun is termed the "bullet group" for that gun.

The primary consideration is to obtain a bullet density which is likely to destroy the expected target.

The *total* "lethal area" of a target is the sum of the various small vulnerable or vital areas in the target in which it is probable that one bullet would result in disabling or destroying one target aircraft.

Bullet density and the size of the bullet group are directly proportional to range, i. e., the diameter of the group at 400 yards is four times that at 100 yards.

DESTROY THE ENEMY QUICKLY

It is imperative, in air combat, that a lethal density be built up quickly because—

The opportunities for accurate shooting are short.

The quicker the lethal density is built up the less likely you are yourself to be shot down.

Increased lethal density can be built up by—

Higher rate of gunfire,
Increased number of guns,
Mutual support between guns of two or more aircraft,
Reduction of range,
Increased caliber of guns.

AIR FIGHTING PRINCIPLES

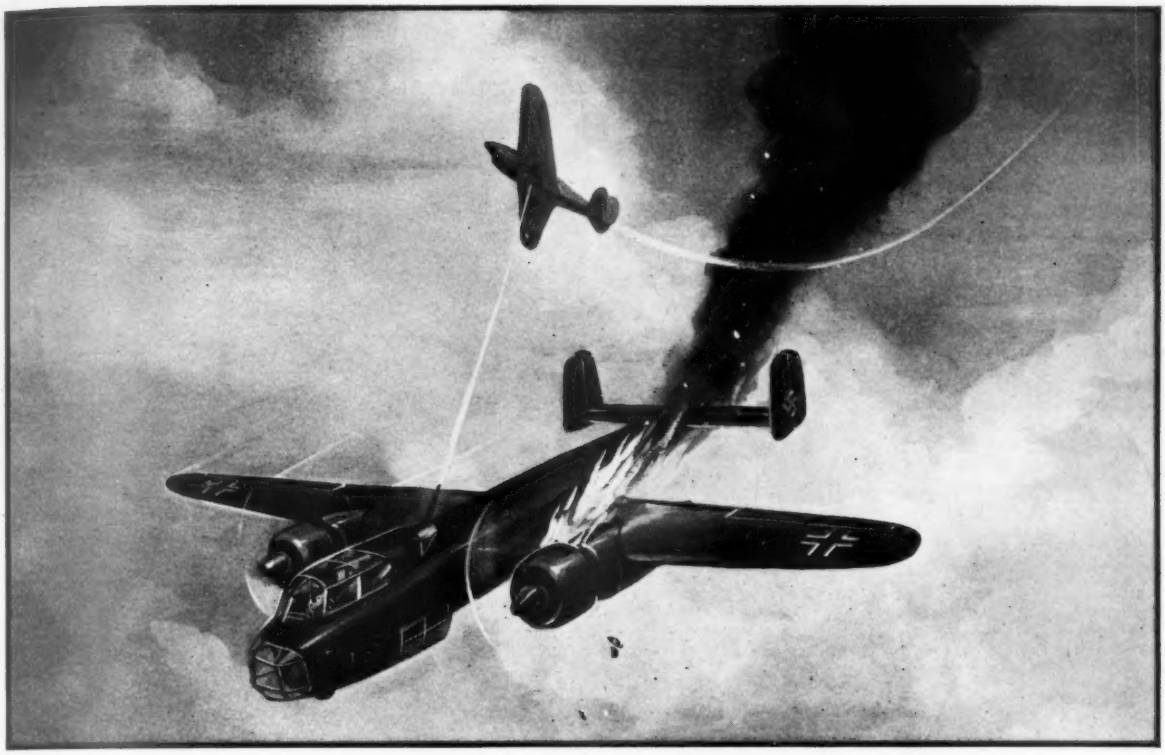
A fundamental of all air fighting tactics is *simplicity* and *flexibility*. Tactics must be simple because of the *time factor*. The speed of modern aircraft does not admit of the development of elaborate formations and attacks. Other factors which demand simplicity are—

Difficulty of control,
Limited vision,
Difficulties of intercommunication,
Fleeting opportunity for decisive air combat,
Necessity of exploitation of varying weather conditions so as to effect surprise, viz.; clouds, sun, haze, dawn and dusk lighting effects.

Another fundamental affecting fighting tactics is *morale* and *leadership*. A high morale is essential. It is dependent upon physical fitness, environment, a contented frame of mind and good leadership.

The leader must possess initiative and skill to judge when and from which direction maximum fire should be brought to bear. He must inspire confidence in air crews and know their ability and limitations. The good leader will aim to achieve a decisive success with the whole force under his command rather than to gain a personal victory.

Surprise is an important factor in air fighting. A leader should maneuver to achieve surprise before attacking, if possible. Surprise may be achieved by—



The attacker is most vulnerable to fire from rear guns when disengaging in haphazard manner.

Attacking from directly out of sun,

Making use of the bank of haze. Aircraft approaching on the same level are difficult to see if they attack from the side remote from the sun. (A bomber, therefore, should try to fly well above the haze level so as to render a concealed approach by fighters less likely.)

In the evening or early morning by attacking from that part of the sky which is darker. By making good use of clouds, or, in the case of fighters, by making an intelligent estimate of where enemy aircraft is likely to emerge.

When enemy aircraft are sighted in one direction, vigilance in other directions must not be relaxed. More often than not other supporting aircraft will be in the vicinity and to launch blithely into the attack on the first enemy seen without a quick search for other enemy planes is a sure way to be shot out of the sky and never know what hit you.

SOME DO'S AND DON'TS

Before taking off or landing, search the sky for enemy aircraft. It is during these moments that your aircraft is most vulnerable.

If you hear gunfire, or see bullets hitting close to you or observe tracers going past *immediately* take evasive action—*then* look around. Don't try to look *before* starting to turn. It might be too late.

ABOUT TIME FOR EVASIVE ACTION

Develop a rubber neck. Keep the sky under constant surveillance.

DEVELOP A RUBBER NECK

Watch your tail.

Conserve ammunition.

Never fly or dive straight when being attacked by aircraft or antiaircraft fire.

Fighters should endeavor not to close in on the enemy at too high a speed during the final stage of the approach or the burst of fire will be too short to be effective, or you may overshoot altogether.

Don't go into the middle of a V of enemy bombers. Attack them from the flank, and from both flanks simultaneously, where possible.

When you are going into the attack, don't give the enemy a chance at a deflection shot at you. As far as you can *keep your nose* on the enemy, and approach his blind spots as much as possible.

In attacking enemy bombers don't fire a long burst if enemy fighters are about; two seconds is long enough. Then break away quickly and look about to be sure no enemy fighter is after you. If all is clear you can take another crack at the bombers, if necessary.

Don't break away in a climbing turn. This gives an easy shot to the enemy rear gunner.

Don't leave your formation, if you can help it, unless ordered to do so.

Don't *ever* fly straight, especially if you are alone. Keep that rubber neck turning continuously and keep a lookout behind.

Don't let the enemy slip out of the sun to get you. In looking toward the sun place a finger or thumb before your eyes.

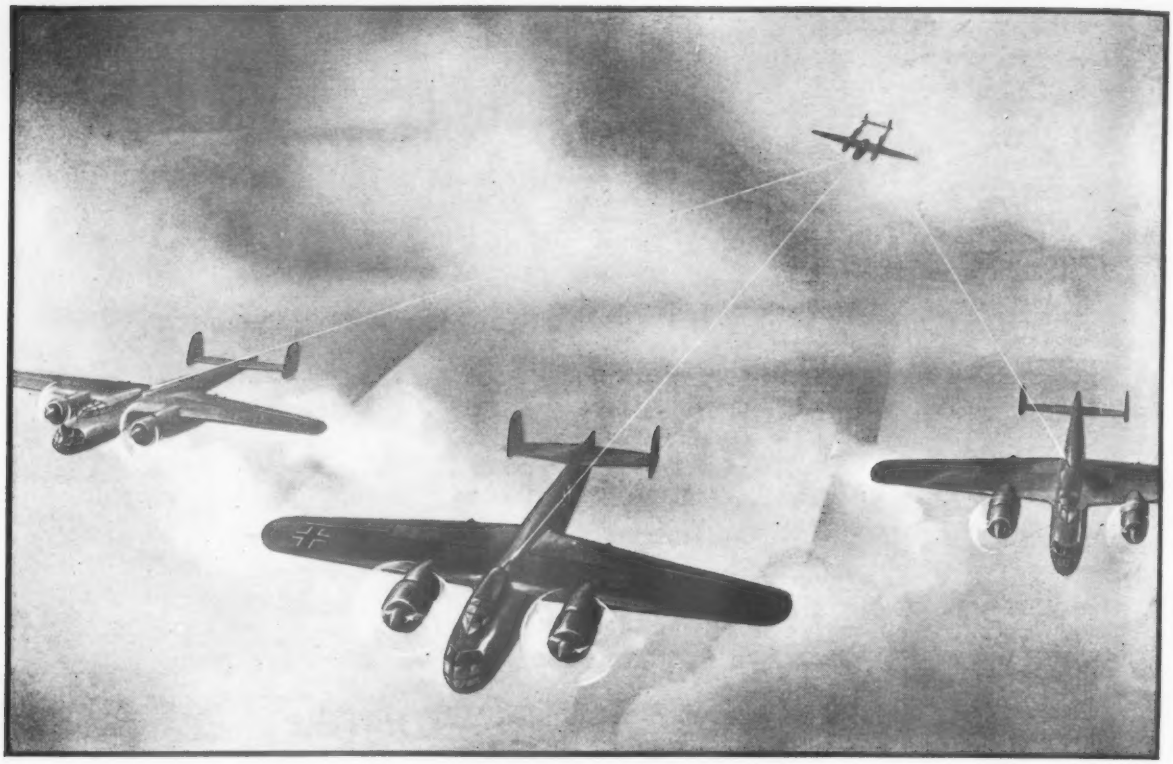
DON'T WASTE AMMUNITION AT LONG RANGE

Don't waste ammunition by firing at long range.

FORMATION PRINCIPLES

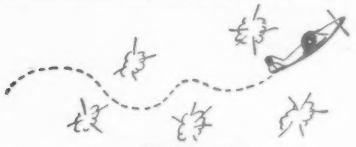
A large formation is more vulnerable to antiaircraft fire than a number of small formations. The larger the formation the less maneuverable it becomes. However, it is more likely to subject attacking aircraft to a superior concentration of fire. With a large formation there will be a tendency for a number of gunners to fire on a few enemy aircraft and to ignore others, and to waste ammunition. There is, therefore, a limit to the size of a formation to obtain economical fire concentration. Aircraft which have blind sectors, or sectors of reduced firepower, need larger formations than those which have all round arcs of fire.

Small formations are less easily seen than large ones.



Eagerness may spoil a combined attack and cause attacking plane to become a "sitter" for enemy.

Every pilot must be able *easily* to see the aircraft on which he is formating. All aircraft in the formation must *keep station* on the leader, and as few as possible



SPOIL THE A. A. AIM

in *sequence*. Otherwise accumulated errors build up and the rearmost pilots have a very difficult task in maintaining proper position.

While being attacked, make it impossible to draw a straight line from the enemy aircraft line of approach through two or more aircraft of the formation. Otherwise the attackers may successfully *enfilade* the formation.

The length of the formation should be equal in all directions, where possible.

All aircraft in the formation, with possible exception of the leader to be equidistant from the enemy aircraft. Thus in defensive bomber formations every aircraft should be spread perpendicular to the enemy's line of approach.

Aircraft in formation should be *sufficiently far apart* to avoid one plane being hit by shots aimed at the other. At the same time they must be sufficiently close to provide maximum mutual support.

Formations disposed in depths create a large volume of slipstream turbulence which, when bombers are being attacked from rear, throws fighters off their line of sight. The *ideal* defensive formation will differ with every method and direction of attack. Each formation must, therefore, possess sufficient flexibility to allow a quick alteration to some other formation.

The *disposition of aircraft* in formation will depend upon circumstances. For example, if attack on a defensive bomber formation is developing from above, aircraft in the formation should be stepped down—if the attack is from below the aircraft should be stepped up. If the attack is from the same level and developing from the beam aircraft should be stepped down (for it is *easier* for fighters to sweep a formation *upwards* than *downwards*. With aircraft on the nearer flank *down* and on the outer flank *up*.)

When encountering antiaircraft fire, aircraft in all sections should be far enough apart to avoid more than one aircraft being brought down by any one antiaircraft burst.

EVASION PRINCIPLES

Always turn *toward* a hostile fighter. Thus you shorten his approach, and therefore make him turn more rapidly. Maybe he won't be able, aerodynamically, to turn fast enough and he may be forced to break away. *Do not* turn *away* from the direction of attack. A straight dive will give enemy aircraft a "sitting shot." You actually appear as a stationary target in such a dive either at a target plane or away from the plane.

TURN TO THE ATTACK

Never change from one turn to a reverse turn. *Wait* for a brief interval between attacks.

Take a quick look about before launching successive attacks.

When hedge hopping, or flying low over the sea, fly an erratic course.

Clouds, except the smallest ones, afford one of the best means of avoiding enemy aircraft. When possible fly near the clouds, but if over areas covered by antiaircraft fire, *do not* fly immediately below the cloud base, as antiaircraft can accurately determine the range from the cloud base.

Do not fly *straight* through a cloud when avoiding enemy aircraft. Alter course in the cloud to turn *towards* the enemy.

Aircraft flying about 20,000 feet are difficult to see from the ground.

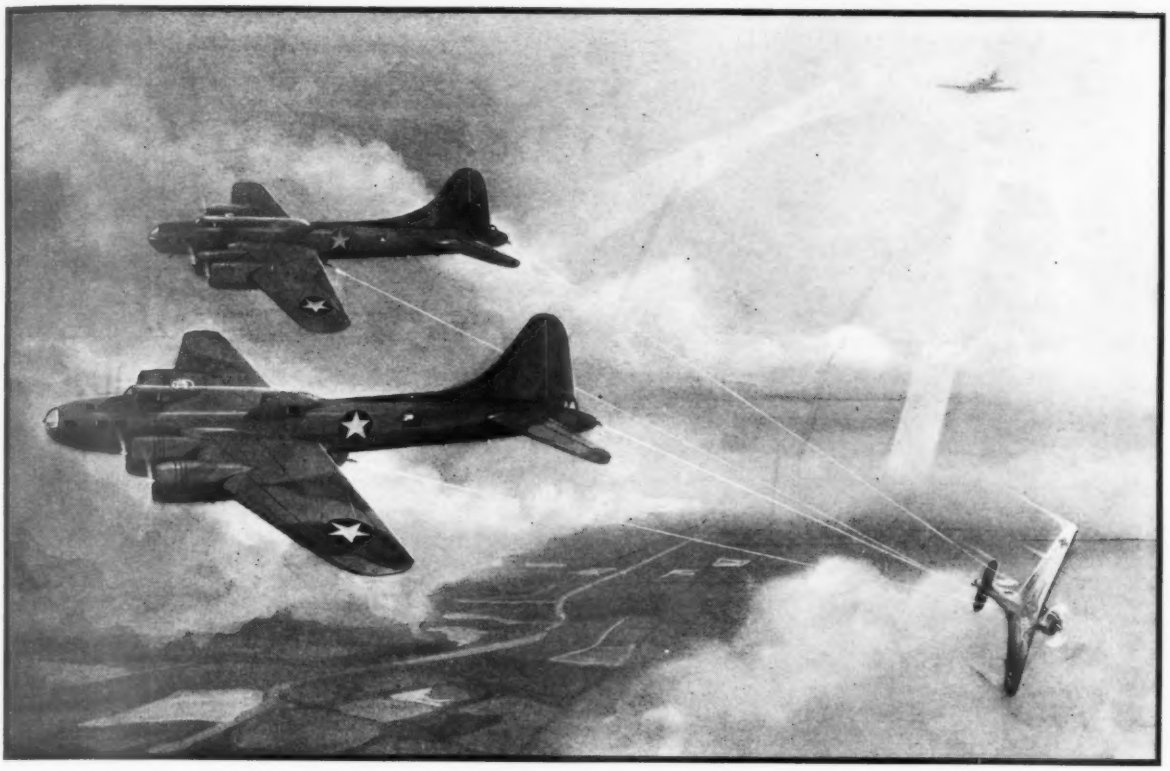
Avoid layers of air in which white streamers form astern.

At night *do not* open throttle because this increases length of exhaust flame which can be seen at long distances.

Show no lights on your aircraft.

Searchlight beams without accompanying antiaircraft fire indicates presence of enemy fighters. Do everything possible to get out of the light.

To evade enemy fighters, fast bombers may be sent in advance of the striking



Decoy often attracts the gunners' attention so another plane may attack unseen from "out of the sun."

force, to draw off enemy fighters. Also planes may be routed on dog-leg courses toward other important objectives with a view of deceiving the enemy as to the actual target.

* * *

Searchlight and antiaircraft at night are directed by sound locators. (Radio aid is also said to be effective.) Sound locators may be avoided or deceived by one of the following means:

1. One aircraft to fly low, making a noise screen which will prevent aircraft flying high from being heard.
2. Gliding over the searchlight or antiaircraft belts in heights in excess of 6,000 feet where aircraft throttled back are inaudible.
3. Simultaneous raids on different or parallel courses at different heights will result in locators getting a false position.
4. Desynchronize engines. This is effective, at least to inexperienced sound locator crews.
5. Most effective of all evasive measures are alterations in course, speed and height.

Sound locator crews usually do not allow sufficiently for the lag in the time it takes the engine noise to reach them which results in searchlights and antiaircraft fire being below and behind. (Recently, it seems, German antiaircraft must be directed by radio-locators. Where radio-directed antiaircraft fire is encountered some of the foregoing suggestions, therefore, will not apply.)

In seeking to avoid searchlights, *turn*. A climb or dive, *without turn* is ineffective.

ANTIAIRCRAFT EVASION

The antiaircraft gunner's greatest difficulty is finding the correct elevation. Consequently a change in height, as well as turning is the best method of evasion. Effective danger area of 3 in. and 4.5 in. shells is from 30 to 90 feet radius. The area behind and below the bursts is usually safe, therefore, it is best to fly below shell bursts rather than above them.

When within range of enemy antiaircraft it is imperative that course and altitude be altered continuously to avoid destructive hits.

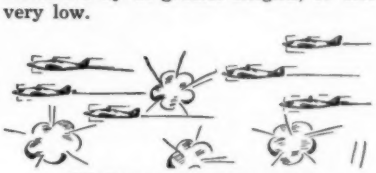
Heavy antiaircraft fire is most accurate between 6,000 and 18,000 feet; therefore, if possible, fly above or below these heights.

The ideal target from antiaircraft point of view is a large formation in line astern. The most difficult for antiaircraft are small sections (of two or three flying line abreast, or shallow echelon, at different heights.

DON'T LEAVE TELL-TALE STREAMERS

At night it has often proved effective to drop a flare or other object, and then dive or climb on a turn. The enemy antiaircraft often concentrate on the flare or other object, and thus enable you to get away.

Short range antiaircraft is usually ineffective at heights above 5,000 feet. Therefore fly at greater heights, or else very low.



DON'T LET ONE BURST GET MORE THAN ONE PLANE

Attacks against defended areas should be made suddenly and *not repeated* for at least five or 10 minutes. Make a low and quick getaway without trying to maneuver to observe effect of your attack.

Low-flying attacks should be made from the direction of the sun, or from clouds and by taking advantage of topographical features.

If both short-range and long-range antiaircraft fire is expected, the best compromise is to fly at about 5,000 feet, at ground level, or above 18,000 feet.

PHYSICAL FITNESS

Physical condition cannot be overemphasized. A tired, exhausted, or poorly conditioned flyer is cold meat for a well conditioned adversary. Top physical condition will not just come of itself. It must be cultivated. Proper exercise, adequate rest, between operational flights will pay the biggest dividends. Sound physical condition will contribute to a high morale, instill an eagerness to get on with arduous tasks, insure the successful operation of the unit.

END

BUSH FLYING—MODERNIZED

Canadian Pacific airliners now fly on scheduled routes from Edmonton to Yukon, Alaska and into the Arctic Circle.

by BRUCE KEITH

Canada's northwestern independent air services have been merged into an efficient airline system operating modern craft 18,000 miles daily.

Photographs by Canadian Pacific Air Lines

CANADA'S northern bush flying routes, famous for aerial freighting to mines, supplying fur trade settlements and undertaking mercy flights, have gone modern. In place of the unpredictable, groping journeys using many small single-engined ships that hopped into land-bound points of the north and out again, Canada today augments its transcontinental airway with a splendidly efficient north-south airline system using fast modern transports and operating on an up-to-the-minute schedule.

The change came a little over a year ago. Motivating force behind the rapid modernization was the Canadian Pacific Railway. At the start of 1942, there were about a dozen important north-south airlines operating in Canada—two of them, Canadian Airways and Yukon Southern Airways—already of important size and scope. The Canadian Pacific Railway consolidated these dozen northern lines into an air transport network under the name of Canadian Pacific Air Lines, Ltd.

In the year and more since its formation CPA, as it is known, has spread over most of Canada from the U. S. border to well beyond the Arctic Circle. It has built up a successful ground organization and has scored outstanding achievements

This is a typical CPA cargo load being loaded aboard a "Lodestar" at Edmonton. Photograph at right shows Air Commodore H. Hollick-Kenyon (left), CPA operations chief, checking a route map.

in the country's air transport development. Its accomplishments augur well for Canada's participation in post-war world air transport, since these intensified north-south lines form a section of the cross-roads of future world aerial highways.

How did a railway company become interested in airline operation? The first step in that direction was made almost 25 years ago, but the immediate cause of Canadian Pacific's all-out organization program was probably its successful handling of the wartime transatlantic ferry service.

At the peace conference following the last war, Canadians helped draw up the International Air Convention. Attention focused on that prompted the Canadian Pacific Railway, which even then had a record of 34 years coast-to-coast rail operation, to obtain from the Canadian parliament a special permit to own and operate aircraft commercially. The permit went unused until 1930, when Canadian Pacific became directly concerned with commercial aviation by subscribing a large part of the stock investment of Canadian Airways, then operating in western and northern areas. In 1937, the company had an opportunity to help promote a transcontinental air route, but re-

Modernization of bush flying brought addition of stewardess to flight crew.

fused because insufficient voting power went with the investment.

During these years, bush-line operators were nursing their craft farther into the northern reaches of Canada. They were pioneering the routes that later enabled Canadian Pacific to develop into a full-grown nation-wide air system in a few months.

In 1939, the airline subsidiary of the Canadian Pacific Railway was forecast by an extensive survey the company made of the country's privately-owned air companies. It was not long before they began dickering to buy out these concerns.

Their progressive plans of air development were interrupted early in 1940, when the Canadian government asked them to assume the responsibility of establishing a transatlantic air service. It was to provide a needed Canada-England air mail link and to beat an aerial path for ferrying U. S. bombers over the ocean.

First job of ferrying was to take over a number of Lockheed *Hudsons*. The administrative staff of the Canadian Pacific Railway's air section came from within its ranks, and the original small group of flying men from British Overseas Airways. Their numbers were soon swelled by personnel of Britain's Air Transport Auxiliary, and pilots from the United States, from northern Canada, and even South Africa, Australia and South America. Pilot schools, radio and navigational training centers, and meteorology offices were created to provide skilled personnel. An ever-increasing tempo of traffic and expansion became the keynote. The first flight of seven *Hudsons* reached England November 10, 1940. By early 1941, the goal was set of having all planes for England that could fly the Atlantic, taken over by the company's ferry service. A program of enlargement of facilities in Newfoundland and at Bermuda was mapped out. Test flights were made with bombers across the Pacific to Manila. Through it all Canadian Pacific gained invaluable air transport "know how." Personnel on the Canadian side was over 1,000 when, with the great increase of Lend-Lease planes to Britain, President Roosevelt asked that the ferrying be placed under military control and the RAF Ferry Command took over. But as operated today, the bomber delivery system is essentially that built by Canadian Pacific. Theirs was a real war job well done.

Back to the internal transport work swung the company's attention with the completion of their ferry work. They plunged into the task of consolidating the small airlines into a network with all the enthusiasm that stems from successful past accomplishments. When the ink dried on the bills of sale, Canadian Pacific owned 10 air systems in western, northern and northeastern Canada. These, with main office locations, were: Canadian Airways, Winnipeg; Quebec Airways, Montreal; Dominion Skyways, Montreal; Arrow Airways, Le Pas, Man.; Wings Ltd., Winnipeg; Prairie Airways, Moose Jaw, Sask.; Yukon Southern Air Transport, Edmonton; Ginger Coote Airways, Vancouver; Starratt Airways, Hudson, Ont.; Mackenzie Air Services, Edmonton.

With these lines, Canadian Pacific got a wide assortment of aircraft—Lockheed *Lodestars* and 14's, Boeing 247-D's, Beechcraft 18's, Barkley Grows, de Havilland *Rapides*, Noorduyn *Norsemans*, Bellancas and Fairchilds. Such diversity has made maintenance more difficult for the company, but has been a boon in carrying on the two distinct kinds of operations—main route, inter-city luxury service in heavy traffic areas, and side-trip bush service to outlying points.

For a year the company planned, organized and constructed to bring the diversified operations of its new collection of airlines into a unified, smoothly-working system. It built new fields and hangars and shops, drafted schedules and transferred equipment. It opened training schools for its flying and maintenance personnel and hired new employees. It established radio control systems and painted its crest on newly-acquired machines.

After its first 12 months, Canadian Pacific Air Lines' president, L. B. Unwin, summed up its accomplishments thus: "During its first year of operations, Canadian Pacific Air Lines flew approximately 6,000,000 scheduled airplane miles. Passengers and mail carried were more than double the previous year (over the same routes). Air cargo reached a record total of close to 10,000,000 pounds, consisting largely of military and air defense freight shipments. On the basis of present operations over 90 per cent of the total traffic handled by Canadian Pacific Air Lines is connected with the war effort. This first year of growth has witnessed many improvements in the Canadian Pacific air services. New equipment has been secured; operating, maintenance and traffic policies standardized on a main line basis; and ground facilities enlarged and modernized to meet the heavy demands of war traffic."

Today Canadian Pacific's 100 or more aircraft fly a regular scheduled daily mileage of about 18,000 miles. A glance at the interlocking routes included in this total indicates how widespread are its present operations and how significant will be its future program.

The most important areas are in the west and north of Canada. There the company has its Yukon District and its Mackenzie District. The Yukon is made up of routes in the "Rocky Mountain Trench" through which the Alaska highway is constructed. Aircraft operate on heavy schedule from Edmonton to Fort St. John and on along the chain of de-

(*Continued on page 152*)

Use of modern radio equipment permits close adherence to scheduled operations despite ruggedness of terrain and lack of ordinary communications facilities.

ASSAULT ON AFRICA

This photograph, taken from the deck of the carrier, shows part of the gigantic fleet that invaded Africa. Planes are "Dauntlesses" and "Wildcats."

by FRED TUPPER, Jr.

This exclusive article is the first to describe in detail the role of aviation in the launching of what has proved to be a major campaign in Africa.

Photographs from the U. S. Navy.

THE order "play ball" came suddenly just before dawn on the morning of November 8. It was *the* hour and *the* day and this was the signal to begin hostile operations. The North African invasion was under way.

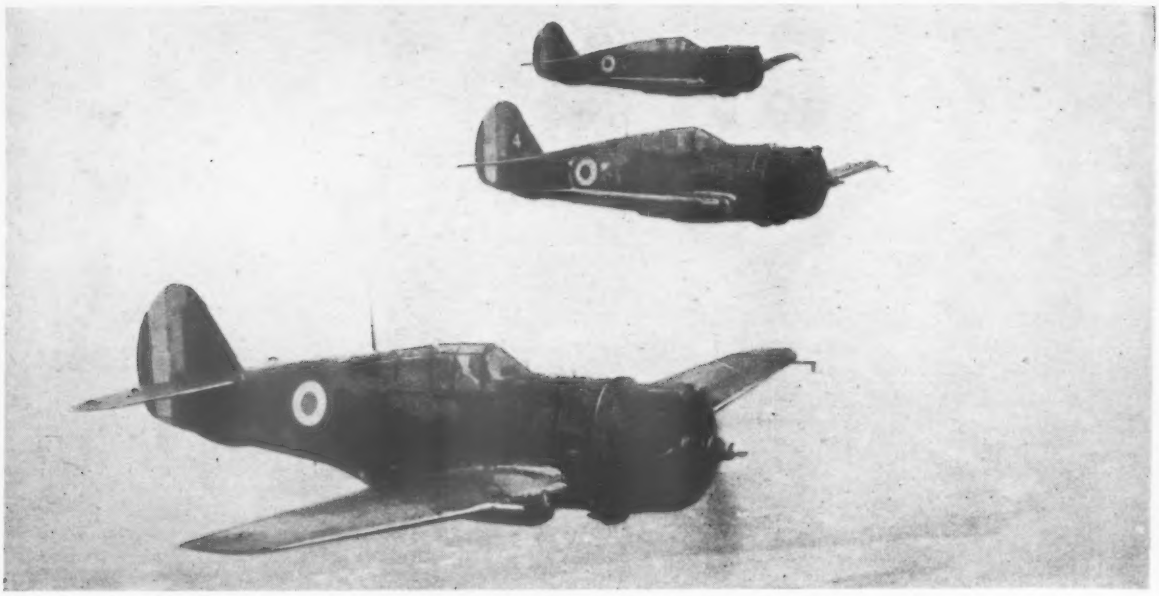
The largest convoy in the annals of man—a great occupation fleet that stretched 25 miles in any direction—had already split up according to prearranged plan, each ship intent on its particular mission.

Aboard a certain Navy carrier squadrons of fighters, dive bombers and torpedo bombers were spotted on the flight deck, primed for action. Pilots in the ready room tensely waited for orders. Then the radio operator flashed word that French submarines were leaving Casablanca and that French light forces, including a cruiser and three destroyers, were steaming up the coast under cover of a smoke screen. North at Fedala, the huge shore batteries at El Hank were training their guns on the landing barges, and the battleship *Jean Bart*, berthed in the Casablanca harbor, was throwing 15-inch shells.

Orders came quickly. Several minutes after the radio report, the whole complement of combat aircraft were launched and in the air. One fighter group attacked the shore batteries at Fedala, another roared over Port Lyautey, strafing enemy gun emplacements. Dive and torpedo bombers went to work on the French ships.

Traffic on the carrier's flight deck was heavy. As quickly as the planes ran out of ammunition, they came aboard to rearm and refuel and got back into action. Everyone wanted to get into the fight. One rear gunner was offered $230 for his seat in a flight. He turned it down. On the flight he was killed by a shell fragment.

Opposition was stubborn. French antiaircraft guns, after the first few rounds, were getting the range and inflicting damage. Many planes came back bearing bullet holes and shell scars. One



Attacking U. S. Navy pilots found themselves facing American-built aircraft. They were French-flown Curtiss "Mohawks," basically identical to the old U. S. Army P-36. Armament was four .30 caliber guns.

Navy pilot, strafing an air field, went so low that he brought back a bunch of foliage in his tail wheel. (A pre-war botanist aboard identified it as eucalyptus.)

The pilots were having trouble, too, trying to silence the French emplacements. Grumman *Wildcats* were carrying 100-pound bombs in an effort to put them out of action. Dive bombers and torpedo planes scored direct hits with 500-pound bombs and wiped them out.

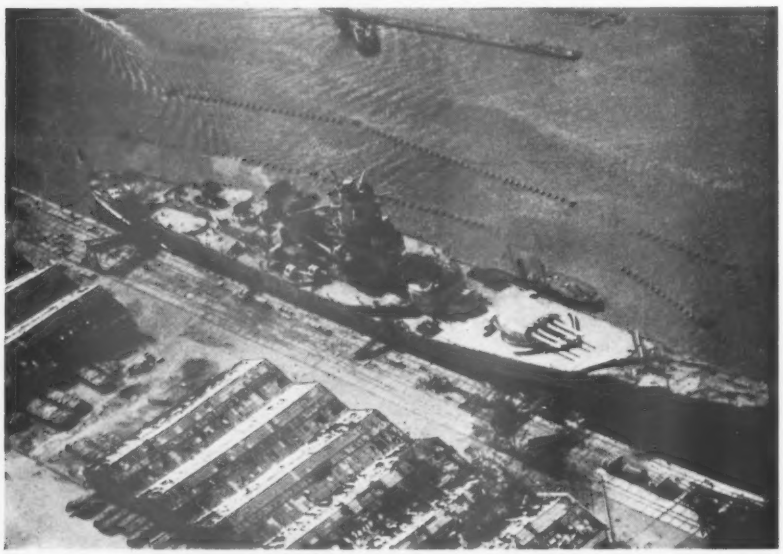
The French light forces proved easier prey. Planes intercepted them early in the morning. By evening they were stranded on the beach.

Occasionally, during that first day, a single French plane would break through the carrier's fighter patrols to strafe ground troops coming ashore from transports. One plane in particular was sneaking over a ridge at low altitude, making a strafing run and then darting back to safety. Camouflaged against the ground, it was difficult to detect but, finally, with the aid of a Naval ground liaison officer, it was located and shot down in flames.

In the meantime, the carrier was making history. In a single day, she set an all-time Navy record for launchings and landings and did it under the constant threat of submarine attack. Many of her bombers and torpedo planes were detailed away from the occupation party to depth charge a wolf pack of submarines.

And yet casualties were low. One pilot, forced to bail out somewhere over French Morocco, was apprehended and incarcerated in the bastille in Casablanca. The jail was just a block from the harbor and the pilot's cell rocked like a bowl of Jello during the height of the bombardment. But the flyer was more disturbed about his personal cleanliness. "I demand my international rights," he screamed during a lull in the crescendo. "I want some toothpaste." And he got it, too. (Apparently, he said later, you don't need to exchange an empty tube in Africa.)

U. S. bombers flying in from the carrier dive-bombed unceasingly the French battleship "Jean Bart." Forty tons of bombs were dropped on vessel and the nearby sheds.



Douglas "Dauntless" circles spot where an enemy U-boat lurks, dropping depth charges.

The convoy to Africa was "the largest in the annals of man, a great occupation fleet that extended 25 miles in any direction." This is part of it, photographed from one of the accompanying carrier's "Dauntlesses."

Another pilot was forced down at sea when his fuel gave out. He was logged as missing. Several months later he turned up in the capital of a neutral country after a series of hair-raising experiences that included keeping afloat for 20 hours by using his trousers as a life belt.

On the second day the carrier's aircraft ran into much sterner aerial opposition. One flight of fighters intercepted 40 bombers, shot down one and dispersed the rest. A second flight ran into a formation of 16 Dewoitine 520's. They collected five "certain" scalps and damaged four more that may have crashed later. Meanwhile dive bombers still blasted the *Jean Bart*. In a single day, according to the carrier reports, more than 40 tons of bombs were dropped on the French battleship. Later inspection showed how deadly was their accuracy.

Other flights were sent inland to strafe opposition troops and tanks converging on Port Lyautey and Rabat. The *Wildcats* swooped low over fields and roads, .50 caliber guns blazing until the tanks were in flames. The enemy troops retreated from the area.

By the third day, the pilots were really "on the beam." They scored heavily against French P-36 intercepters in the air and bombed and strafed planes on the ground. During the overall engagement 26 French planes were shot down and another 100 destroyed or incapacitated before they could take off. And yet, during this intense action, "not one United States plane was destroyed in combat," according to official reports.

But it had been tough sledding for the carrier. "We were just lucky," a high-ranking officer said afterwards. "Damn lucky." He pointed dramatically to the carrier's log for a morning operation. It

(*Continued on page* 174)

Pilots aboard a carrier accompanying the invasion fleet lounge below decks in the ready room. Officer in the center of the photograph is reading RAF Issue of FLYING.

PLASTIC PLANES

Enclosed in an airtight rubber bag, half of a plastic-bonded plywood fuselage is placed in a "steam cooker."

by WILLIAM WINTER

Popularized as "plastic" planes, the plastic-bonded plywood aircraft has made a notable contribution in meeting the metal shortage.

TEN years ago the proverbial "song" would have been too high an asking price for the future of the wood airplane. Because Knute Rockne died in the crash of a wood-winged trimotor Fokker F-10, the then Department of Air Commerce immediately grounded all wooden transports. But if the wood airplane wasn't worth a plugged nickel 10 years ago, today it is achieving an industrial revolution which we hesitate to label either minor or major. The development of plastic bonding agents and new molding techniques have given wood an aggressive new lease on life.

Modern wood airplane construction has certain important advantages. It saves tons of aluminum, opens up new vistas of labor supply and affords excellent flight performance. Of singular significance is the fact that England, Russia, and Italy consider the latter consideration on a par with the first two advantages. Though the deHavilland *Mosquito* and many of Russia's fighters are mostly wood, America, at the moment, is preoccupied with the labor and materials aspects. Starting with trim tabs, wood applications have increased enormously in the past three years. From bomb bays doors, fairings, wing tips, fuselage sections, it was only a logical step to entire wing panels and fuselages and, ultimately, airplanes completely of wood. The Fairchild *Yankee Doodle* (AT-21) and the Curtiss *Caravan* (C-76) so far are the high water mark. Whether or not we see wood combat planes in this country depends purely on the length of the war.

"For the want of a nail a kingdom was lost" could be said of the long delayed renaissance of wood. The difference between the fatal old style wood fabrication and the present promising methods can be spelled in four letters: G-L-U-E. The animal and vegetable glues used previously were susceptible to dampness and termites. Because inspection inside of a glued section wasn't possible, old-timers used to say that wings held together as long as the termites held hands. Modern plastics have changed all that. In the "cooking" process plastics impregnate the wood and lend to it their own characteristics. Thus the plastic plywood airplane is impervious to salt water, acids and alkalis. Termites—nemeses of wood construction—are frustrated. Plastic plywood withstands a wide range of temperature and for equal strength-weight burns through more slowly than a sheet of aluminum or stainless steel.

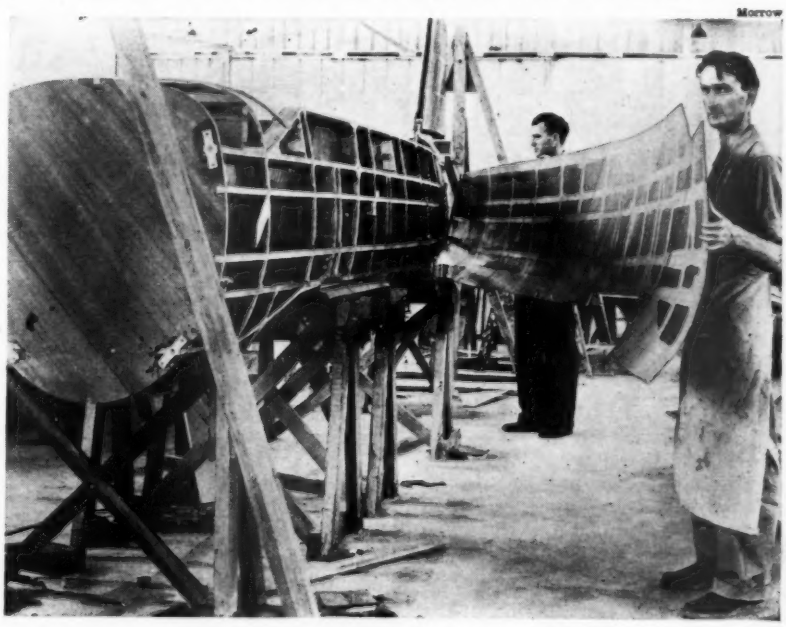
International

Finished veneer fuselage part is lifted from mold to be joined to section on bench at left. Note smooth surface, also that rings and stringers form an integral part of structure. Lightness and strength are basic features of plastic-bonding process.

Plastic bonding agents made possible the molding of wood veneers into everything from bulkhead rings and air scoops to entire fuselage shells and wings. Briefly this process consists of placing plastic-coated strips of veneer over wood molds, each layer being at right angles to the adjacent layers. The entire assembly is then placed inside a large rubber bag from which the air is exhausted, and inserted in a pressure tank or "autoclave." Steam is admitted into the tank, applying automatically both pressure for clamping down the veneers and heat for "cooking" them. The plastic softens, impregnates the wood and after 40 minutes to two hours when the steam is shut off, the impregnated plywood sets as an infusible shell. Compressed air continues the pressure while cold water sprayed over the bag chills the material. Skin and framework, if any, are bonded without even the use of a nail.

The advantages of plastic plywood accrue to its being thicker than metal of an equal strength-weight ratio. Aerodynamically, the thick-skinned, smooth-surfaced wood wing increases lift and decreases drag. NACA tests prove it

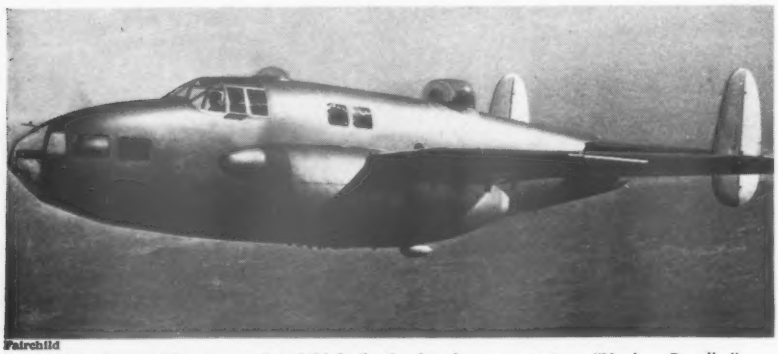
Morrow aircraft use plastic resin adhesives which require no heat or pressure. Skin is molded to correct shape, then attached to fuselage.



Morrow

Langley

Among the new plastic-bonded plywood airplanes, the Langley is made by a process using heat and pressure. Two 65 h.p. engines give it 125 m.p.h. cruising speed.



Fairchild

Using Duramold process, Fairchild built the bomber-crew trainer "Yankee Doodle." This plane is in the 200 m.p.h. class and is powered by two Ranger in-line engines.

U.S. Navy

Clean lines possible through plastic-bonded plywood construction are noticeable in Timm "Tutor," two-place trainer which has a 220 h.p. radial and speed of 130 m.p.h.

Basically an all-wood airplane combining molded plywood, laminates and plain lumber, Curtiss "Caravan" has great load-carrying abilities. It will carry troops or cargo.

Curtiss-Wright

superior even to flush riveting and joggled joints. Being thicker it does not flex or "oil can" like sections of thin metal skin do. Surface imperfections and fluctuations of the skin depreciate performance and contribute to disturbing the boundary layer of air over the wing.

Because it is thicker, plastic plywood has greater "local strength" and closely approaches the ideal monocoque construction. Surface stiffeners are eliminated. Small metal pieces and rivets are eliminated by the tens of thousands per airplane, with an obvious reduction in the variety of jobs common to metal airplane building. Unskilled labor is easily trained in a minimum of time for the building of the wood plane. Curtiss was able to subcontract over 60 per cent of the *Caravan* to makers of hogsheads, pianos and station wagon bodies. This very simplicity of structures and technique is something you can't fail to get once you've seen both metal and wood airplanes built. There is a certain naturalness about the wood shell, particularly for small aircraft. The faint hiss of steam of the autoclave is a challenge to the clattering riveting gun. But all this points out only the major aspects of wood. There are other advantages.

The laminated plastic plywood will not splinter. Bullets and shell fragments leave comparatively clean holes in going through a wing or fuselage, whereas in metal the exit holes invariably are big and jagged. At the exit point the torn metal flowers or blossoms outward. The thick wood skin vibrates less readily than metal, hence is less subject to "fatigue" and more conducive to soundproofing.

Though there may exist a feeling to avoid calling the plastic-molded plywood airplane a "plastic plane," such a term is actually not amiss. Gordon Kline of the U. S. Bureau of Standards said, ". . . the term 'plastic airplane' is applicable only when use is made of the synthetic plastics to impregnate the veneers sufficiently to adequately protect the wood from absorbing relatively large quantities of water and prevent its deterioration by wood-destroying fungi as well as act as a water resistant bond for the various layers of wood. Such a material is simply another type (wood base) of the well known paper-base and fabric-base laminated plastics."

The magical synthetic resins which provide the successful bonding agents are one of four divisions of organic plastics, the others being natural resins, cellulose derivatives and protein substances. Inorganic plastics include concrete, ceramics, cement and so on. The synthetic resins can be simultaneously heated and molded under pressure to various shapes. Some, technically called thermoplastics, can be resoftened by heating, others, called thermosetting plastics, set permanently when once heated. Celluloid is a thermoplastic, Bakelite a thermoset. Whether used pure for wind screens, transparent noses and turrets, or reinforced for gears and pulleys, or with veneer for fuselage and wing shells, plastics are shaped or molded under heat

(*Continued on page* 175)

LONDON SURVEY

by E. COLSTON SHEPHERD
Editor, "The Aeroplane," London, England.

An Air Transport Command has been organized by the RAF, emulating the successful USAAF group.

MOST important of recent developments in Great Britain is the decision to set up an Air Transport Command of the RAF corresponding in some respects to the command of the same name in the U. S. Army Air Forces. It is intended to do much the same work. Its function will be to transport by air those arms, stores and people urgently needed in military operations in distant places.

It must not be confused with the Army Co-operation Command already in existence. That command has its transport obligations. Apart from its primary purpose of affording fighter cover, bomber support and reconnaissance service to the army, it is responsible for delivering paratroops and glider-borne troops to the scenes of their prescribed operations. Beyond that—and the dropping of supplies by parachute to troops in advanced or exposed positions—its transport duties do not go.

All the rest of the air transport work must presumably be done by the Air Transport Command. If the question is asked as to how the transport work has been done hitherto the short answer would be: "By ship." In the interests of precise accuracy I must acknowledge the deliveries made to the army and air force in Egypt by the U. S. Air Transport Command and the carrying by British Oversees Airways of certain urgent stores from Great Britain to West Africa and thence, not only to army headquarters in Egypt but right forward to the advancing troops in Libya. An airliner of British Overseas Airways, in fact, was the second British plane to land at Tripoli.

The volume of airborne traffic which contributed to the victory of the Eighth Army was negligible in relation to the millions of tons of material delivered by ship to the army and air force in Egypt. And yet the beginnings of an air transport service were to be seen during the long pursuit from El Alamein to Tunisia. The RAF Middle East Command carried hundreds of tons of fuel and other necessary equipment forward as the army advanced. Some of these things were for the army; some were for the air force.

So swift a pursuit over scorched desert earth would not have been possible without this help, especially up to the time when Benghazi became open to Allied shipping. At the extremity of the service, these improvised and borrowed transport planes were working at a range of fully 600 miles from the main bases. A great many of them were British bombers filled with whatever room could be found for; others were American aircraft including a few of the transport types now so largely in use by the U. S. Army Transport Command.

Since those days the work of the U. S. Transport Command has shown how much can be done with aircraft to supplement carriage by ship. During the past year and a half Great Britain has had enough experience in the delivery of aircraft across the Atlantic through her Ferry Command to show the possibility of a big carrying service. The impetus towards the establishment of a British Transport Command is thus easy to trace. Examples from the United States and experience over the Atlantic and in North Africa are combined in the resolution. A natural decision on the practical side was to make the new command embrace the older Ferry Command and to put British Overseas Airways under its wing.

The strength of the American example is seen in that. Probably there is a deeper reason for the wholesale adoption of the American model in this respect. Some form of civil air transport is obviously needed by all the belligerents for maintaining contact with neutral nations. British Overseas Airways has been working exclusively on government business for a full two years, but that fact was not evident to the outsider. Now there can be no further doubt.

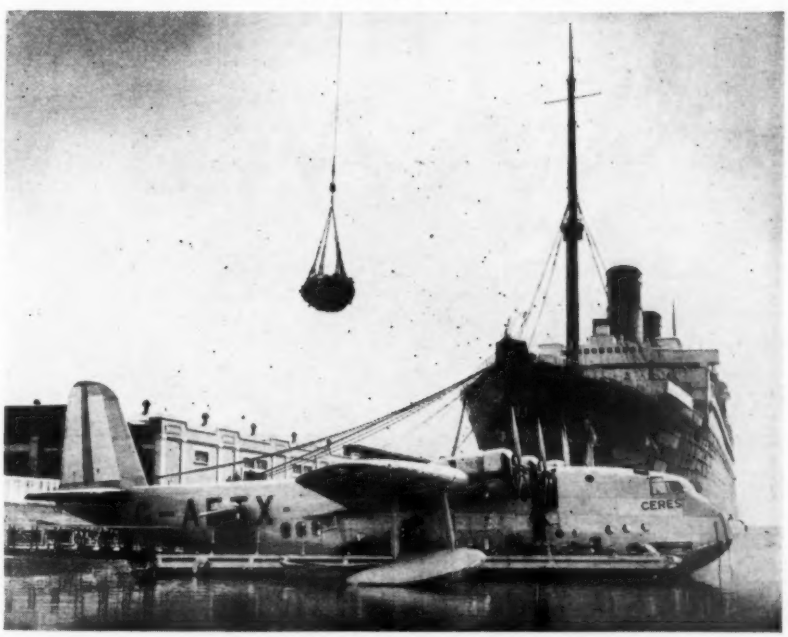
As far as we can see, the new RAF Transport Command will need a good deal of support from the United States. A certain number of converted bombers will be supplied to it. The best of them, like the *York*, which is the transport version of the Avro *Lancaster*, will serve its purposes well, for it boasts an entirely new fuselage. The others are not likely to undergo much modification. They will more probably be just bombers without the gun turrets and the bombing equipment and they will not be capacious enough for the more bulky loads.

No real transport plane is in production in Great Britain and no news of plans for the production of transport aircraft is in the air. If a start were made now on transport types, three or four years would pass before these could be ready for service. Designers in this country have not been at liberty so far to prepare civil designs. The control of labor, even in the drawing office, by the government has prevented firms from doing any work in that direction. Furthermore, draftsmen have announced their unwillingness to be put on work which they considered had no direct relation to the war effort.

This is not to say that no British designer has a design for a civil plane up his sleeve but it does mean that no firm

(*Continued on page* 173)

Transfer of American transport planes to the new RAF Air Transport Command will augment craft such as the "Ceres," typical of few British commercial planes extant.



A natural aptitude for mechanical detail placed Mrs. Dwan Winans in TWA's propeller governor overhaul department.

THE WAMS

by IDELL D. HAYS

Photographs from TWA

Not to be outdone by their sisters in the WAVES, WAACS and SPARS, the women apprentice mechanics of Transcontinental and Western Air are doing a man's job in practically every department of the airline – and doing it well.

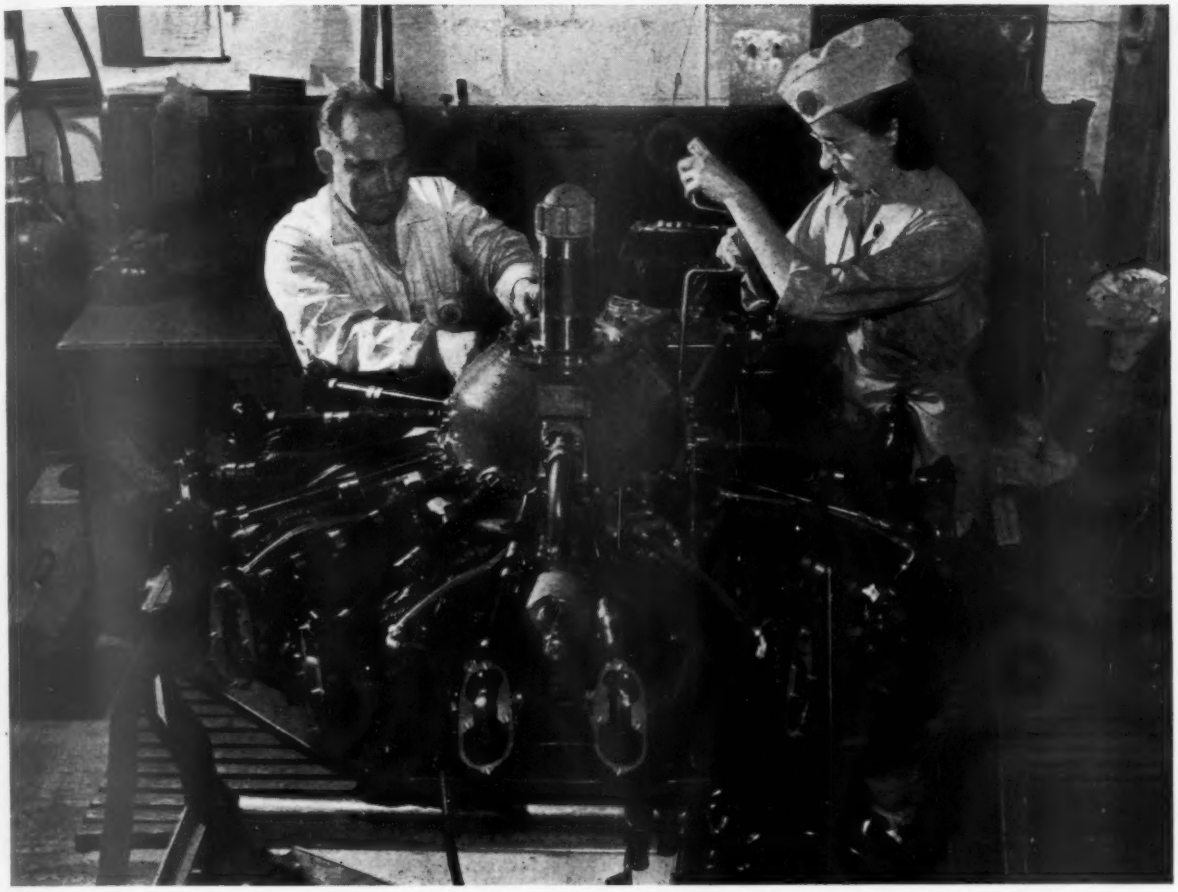
THE WAMS have broken fingernails and smudges on their cheeks, but they don't mind.

If they'd wanted to be white-collar glamor girls, they'd have remained at their former jobs—as artists, clerks, beauty experts and hair dressers, or just wives—instead of joining the WAMS—Transcontinental and Western Air's Women Apprentice Mechanics.

There were 110 of them in April at the Kansas City base, where TWA had tested the idea with such success that the Burbank, Calif., and La Guardia, N. Y., bases began making similar plans. On other airlines, too—such as United, American and Northwestern—women are taking over many jobs in the mechanical departments.

"Right now, it's just a wartime measure," says James Wilson, TWA's maintenance employment supervisor at Kansas City. "But after the war, maintenance departments are going to be much bigger and more people will be needed. Then, as now, experience and skill will be the valuable qualities, whether the workers are men or women."

Clad in trim tan coveralls and wearing overseas caps, the WAMS have worked —and literally!—their way into every corner of the shops. And by proven



The WAMS are not even stumped by the detail involved in engine overhaul. Here Mrs. Rose Hollis aids Mechanic Olin Carl.

ability, they are still working there.

"Our first girl was hired last August," says Wilson, "to do radium dial painting in the instrument department. Since then we've been adding women to all our employment lists. Daily the places where women can be used and are needed are multiplying.

William Maxfield, TWA superintendent of maintenance, who began a search for "mechanical girls" some months ago, reports that the company's feminine employees now total 35 per cent, as compared to only 20 per cent last year.

On being accepted into the WAMS, the women are assigned to whatever department they seem to fit best, or wherever they are most necessary at the moment. The foremen in these divisions teach them the work.

The radio and electrical division is as technical as any in the plant. In a department of 100, now 20 per cent are women.

According to A. T. Stubbs, foreman, "These jobs are just *made* for women—or vice versa! Much of the work is of the precise, detailed type in which women excel."

Some are tackling tasks in the electrical engine build-up. Teresa Guagenti "matches the men in ability," and has her foreman's commendation as being "exceptional in her work." Grace Johnson, who has had supervisory training, works in the spark plug room and is considered "an adaptable aircraft person."

Skill is needed in all the jobs, from overhauling relays, microphones and control units to making engine electrical harness in the accessory shop. Though men still direct the work, there are many assistant jobs that come within the scope of a woman's ability.

"The women in this division have been serious about their assignments, so far, and are speedy and efficient. We are teaching them," Stubbs says, "that they're not just handling tools but that their jobs are imporant."

Previous training is not necessary for radio and electrical workers, though the division needs those who are mechanically minded and possess ingenuity.

There are 16 WAMS on the payroll in the mechanical division of the instrument section, one of the most adaptable departments for the woman worker. Training is not essential here, either, though a knowledge of physics and mathematics is a great advantage and the ability to concentrate on detail is important.

Here in William Dahnke's department

(*Continued on page* 168)

Audrey Kennedy now paints instrument dials with radium. She was an artist.

These O3U-1's are parked outside the hangar at Chicago's Navy Pier. Though unflyable, their engines still run.

SCRAPPED VETERANS

by C. BUDD DUGAN

Photographs from U. S. Navy

An old airplane dies gracefully when the Navy assigns it to the important job of revealing its secrets to tomorrow's machinists.

NEARLY 80 planes stand like dejected old maids on Navy Pier at Chicago. Their props will turn and their controls are in working order, but there isn't a chance that any will ever fly again for these craft have been "surveyed"—assigned to the graveyard and this is their last stop. If they ever leave the pier at all, it will be as scrap.

Here, and at five other Naval Air Technical Training Centers throughout the United States, are the cracked-up, the obsolete and the retired planes of yesterday's Navy. They are serving their last tour of duty and at the same time performing perhaps the most important jobs of their careers—that of training the machinists' mates and metalsmiths of tomorrow's fighting Naval air forces.

Among them stand several modern planes. They seem haughty and rather like plump debutantes at a dowager's tea. New and fresh from the assembly lines, they are the answer to the training officers' pleas for new type planes to be used in machinist training. Old planes are fine for fundamentals, but graduate ground crew members must know something about the aircraft they soon will service on the fighting fronts.

Among the new planes is a Curtiss *Seagull* with only 13½ hours recorded on its log; a Grumman *Avenger* with 15 hours and a *Corsair* with 33 hours. Flown almost directly from factories to the nearby Glenview Naval Air Station, they were then trucked to the pier.

Once a recreation center, Navy Pier was taken over by the Government six months before Pearl Harbor for the training of internal combustion engine experts and aviation machinists and metalsmiths. Huge rooms were turned into messhalls, dormitories and shops. Engine and airplane parts were shipped in for classroom study.

Squadron Operations was established and an order was placed for a 100 by 300-foot hangar to house the unit's planes. At first, with no Naval craft available, old civilian planes were used. Later came the first of the Navy airplanes. Stripped of their wings and undercarriages, they were loaded on freight cars and shipped in. Some, as were the new planes, were flown to Glenview and trucked.

Long out of flight service and worn after student-machinists' handling, Grumman SF-1 is scrapped.

On arrival at the pier, all planes are stripped of radio equipment, flight instruments and armament. The radios, instruments and guns are then shipped to schools teaching these subjects. Engine instruments are left intact in the planes.

Lieut. Daniel J. Bell of Squadron Operations, has two definitions of the work of this unit—his own and the Navy's. His is a bit more colorful:

"The men have already become familiar with the different parts of airplanes in the shops where they studied them in pieces. Here, for the first time, they work with the entire plane—they handle 'em, smell 'em, taste 'em, feel 'em and cuss 'em."

He then quoted from the Naval description:

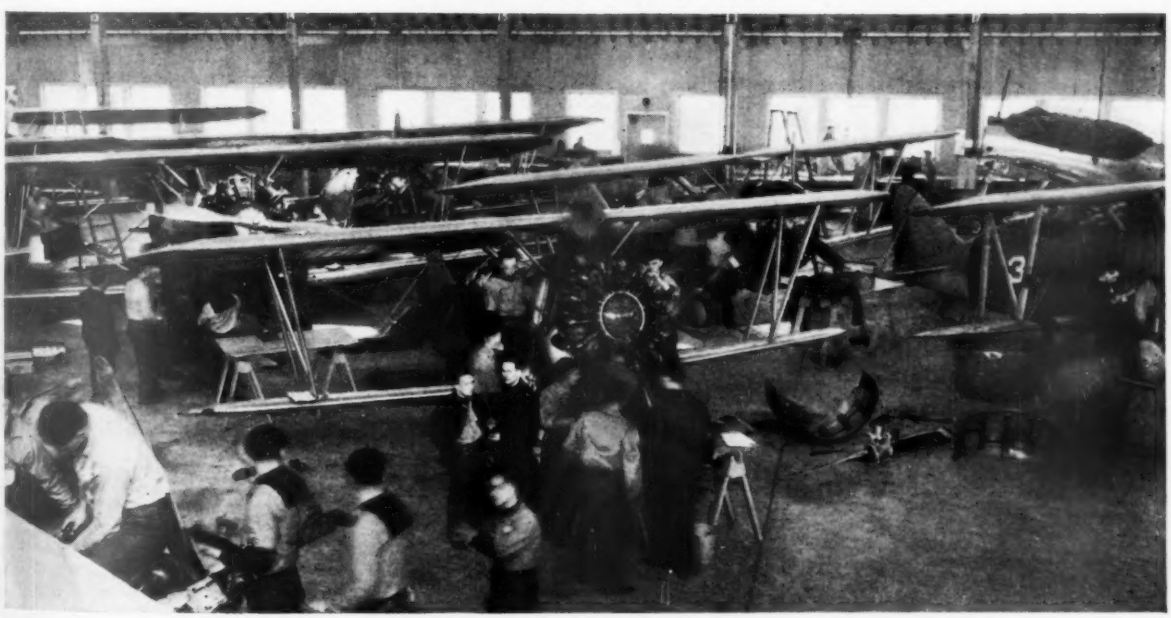
"Work in Squadron Operations provides as much practical experience as possible in aircraft servicing. In addition to preparing a plane for flight by starting, running-up and stopping the engine, the trainee will handle the plane, servicing it by ship and shore methods; run inspection and engine checks; learn maintenance in accordance with the daily and 30-hour inspection forms; do routine upkeep and minor repairs and replace major assemblies."

Twice each day almost every aircraft is wheeled outside the hangar and the engine is started. It is a squadron rule that no engine operated by a student be allowed to rev up over 1,450 r.p.m. and that the student in the cockpit hold the stick well back. Men on each wing make sure that no plane jumps its chocks.

To the armchair admiral used to the storybook "spit and polish" of Naval equipment, some of these planes may be a sorry sight. They are never painted

(*Continued on page* 172)

O3U-1's and an F2F (far right) are being given daily checks by student machinists' mates.



REPORT FROM WASHINGTON

By special arrangement, this monthly feature appears simultaneously in FLYING and "The Aeroplane" London

SINCE Pearl Harbor, the development and extension of domestic commercial air transportation has necessarily been temporarily suspended except as to services considered vital to the war effort. However, air carriers, potential air carriers, aircraft manufacturers and trade associations, as well as Federal and state aviation authorities, airport managers and other interested persons, have given considerable thought to the future development of long- and short-haul air transportation in the United States. In some cases this interest already has taken the form of applications for certificates of public convenience and necessity authorizing new air routes. These applications are now pending before the Civil Aeronautics Board.

While chief emphasis has heretofore been placed upon the development of long-haul traffic between major centers, a proper development of a nation-wide air transportation system should make provision for service to small communities and between cities whose interests may be considered as largely local in character. In fact, by 1941, the need for development of local services had become increasingly apparent and although the war halted expansion in this field it certainly did not stop planning for the future.

To date considerable interest has been evinced in the pick-up type of short-haul service in which the aircraft uses a specially designed hook-device to pick up mail and light cargo from small fields without the necessity of landing. At present there are 23 applications before the Board for certificates authorizing pick-up transportation operations, which propose to cover 29 states and 1,453 cities. The only pick-up service now operating is that of All American Aviation, Inc., which flies a 1,386-mile route extending into New York, Pennsylvania, Delaware, West Virginia, Kentucky and Ohio, and serves 115 cities. All American uses 245 h.p. Lycoming-powered Vultee (Stinson) *Reliants* adequately converted to pick-up service but primarily designed as an airplane for the industrial and sportsman pilot.

This company began operations May 12, 1939, as a mail carrier under contract with the Post Office Department, pursuant to the Experimental Air Mail Service Act of 1938. Later when the operation was certificated by the CAB under an amendment to the Civil Aeronautics Act of 1938, no authority to transport passengers was given because the carrier admitted that its service was experimental and that suitable types of aircraft adapted for combination passenger and pick-up and delivery operation were not yet available. The present operations of All American have advanced beyond the purely experimental stage but are still definitely in a period of development.

Technical development in pick-up operations has been directed—largely to perfecting the actual pick-up device while the fundamental design of the aircraft itself has remained unchanged. Aircraft manufacturers planning for post-war commercial production can be expected to give consideration to a plane specifically designed for more efficient, economical pick-up operations. The extent to which this type of service will meet the public need for a local or feeder air service is one of the problems which must be considered by the CAB.

L. Welch Pogue, chairman of the Civil Aeronautics Board and author of this article.

Another type of service which has "feeder" or local potentialities was inaugurated on July 6, 1939 when Eastern Air Lines began transporting mail from the Camden Airport, N. J., across the Delaware River to the rooftop of the Philadelphia post office building. Eastern operated this service with a Pitcairn autogiro, able to carry 250 pounds of mail. Although the service was discontinued it must be recognized as having contributed to the development of aviation and as an indication of what could be accomplished in the use of equipment of this general type.

Development of the helicopter, and other rotating wing aircraft, is now assuming increasing importance and the future use of such aircraft in local air transportation has great potentialities.

A more conventional method for meeting local air transportation needs is the ordinary airport-to-airport service, requiring landing to load and discharge traffic. The development of aircraft with low operating cost and capable of using small airports is of primary importance in such service.

Today the airline operations of the United States are mainly trunk lines which, prior to Pearl Harbor, covered some 41,000 route miles, stopping as a general rule at larger cities only. In contrast, our railroad system operates more than 244,263 of main line track miles and, with the bus operators, brings transportation service to thousands of small cities and towns that now are looking toward the skies.

In the past, operations over light traffic routes have in some instances been conducted with relatively small transport aircraft of correspondingly low per mile operating cost. However, operators shifted to larger, more luxurious equipment in order to meet either competition or the pressure of public demand for the same type of planes used on the main trunk lines. Development of transport aircraft in the past has been focused principally on production of larger, faster, more luxurious types to meet the ever-mounting service needs of the great trunk lines. Consequently, the light traffic carriers have been generally forced to choose between outgrown "hand-me-downs" or planes of greater capacity than could be utilized. They have usually and quite understandably adopted the latter alternative. Their choice lay between obsolete and modern equipment.

The lack of modern aircraft scaled in size and speed to meet the typical traffic and airport limitations of small cities has been unfortunate. As the light traffic carriers replaced old equipment with new equipment, over-sized for their needs, they sought upward adjustment in mail pay to meet the widening gap between operating cost and commercial revenues. Equipment replacements frequently have resulted in carriers being compelled to discontinue services to small communities on their routes because the new equipment could not safely land on or take off from the small airports.

While the CAB exercises a degree of control over the equipment used by a particular carrier through its power to fix mail compensation, this power is limited by the provisions of the Civil Aeronautics Act specifically prohibiting the Board from restricting the right of a carrier to add or change schedules, equipment, accommodations, or facilities as the development of its business and the demands of the public shall require. Thus, future development of local or feeder air transportation services may depend upon legislative sanctions which will enable the Board to so regulate these services that they will retain their identity as local or feeder services.

Twin-engined aircraft are now standard equipment on our domestic airlines

(*Continued on page* 170)

Dive-bombing equipment adds less than 200 pounds to plane's weight. With Allison engine, speed is 400 m.p.h. plus.

North American Aviation

ATTACK-FIGHTER

RAF first used "Mustang" for ground-strafing over France. It has six .50 caliber guns, high-speed automatic camera.

British Combine

FEW military airplanes in this war have stayed strictly within the category in which they originally were designed. The North American *Mustang*, for instance—a conventional single-engined fighter—has just been adapted for dive bombing by the USAAF. The *Mustang* got that way based largely on British experience. The RAF for some time has been converting fighters like the *Hurricane* to fighter-bombers. The *Mustang*, now a dive bomber, designated A-36 (the P-51 will continue as a fighter), also is a deadly fighter with six machine guns after dropping its bombs.

Hawker "Hurribomber" was first RAF fighter to be converted to ground-strafer. This type carries bombs and eight .30 caliber machine guns.

British Combine

RIDING THE 'LIGHTNING'

by PAUL PIERCE

Flying's correspondent, who knows an unusual experience when he sees one, goes for a "piggy-back" ride in an intercepter.

Photographs from Lockheed.

DON'T let anybody kid you about that fast, sturdy, flashing hunk of lethal airplane—it's *Lightning!* It's a big lightning, and I can prove it with facts and figures hitherto restricted by the Army. I can prove it also by telling you how it feels to ride as a passenger in one of the fastest, highest-flying hardest-hitting and best-protected of all fighters.

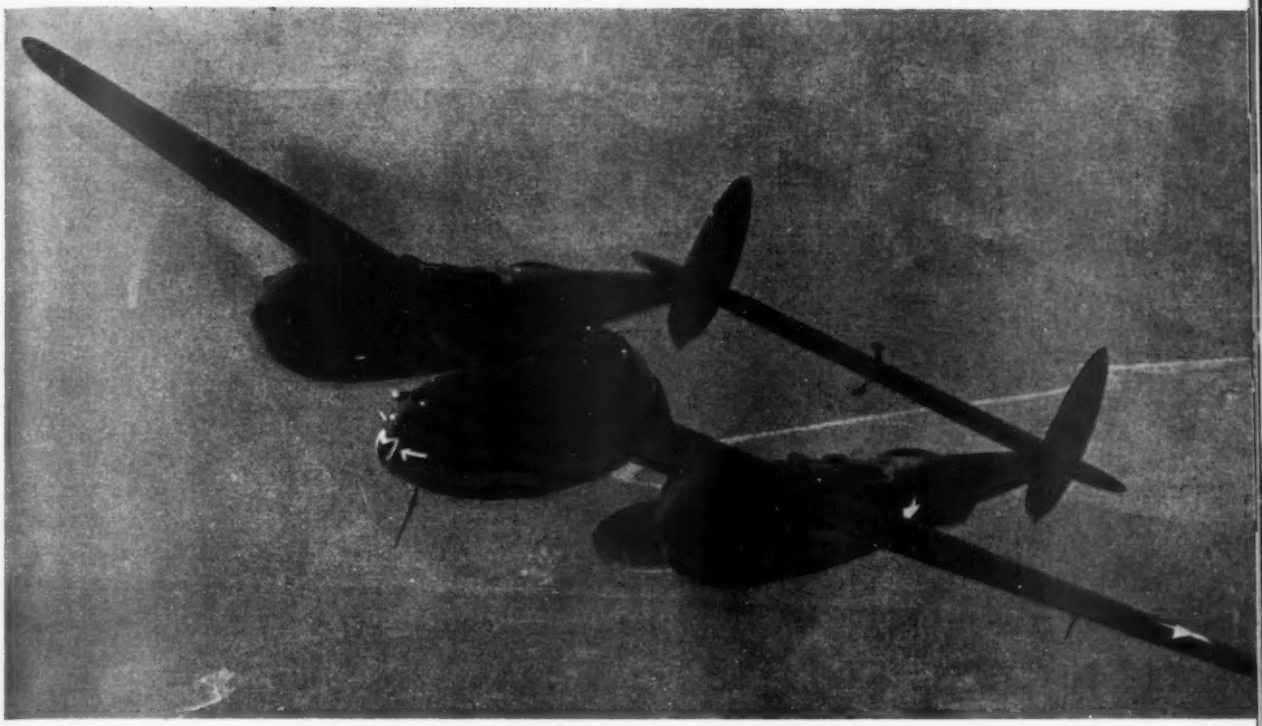
The carefully guarded talk of my test pilot friends never quite satisfied my curiosity. The *Lightnings* flashing over my house every day only partly verified my guesses. It took a ride to find out the truth.

My pilot was Jimmy Mattern, 10,000-hour veteran of Army, barnstorming, mail flying and round-the-world hopping. Jimmy is one of Lockheed's test pilots and a specialist on P-38's. He knows them — and he loves to show what they'll do. That's why he's been assigned to the "piggy-back" plane being used to demonstrate single-seat twin-engined fighter technique to commanding officers and flight leaders of Army fighter bases, who pass their observations on to their men. This new method of pilot training has already cut flying accidents from an index of 6.5 to a new low of 1.5 within two months.

Jimmy was standing on the flight line when I arrived at the airport. The overcast was almost solid over Burbank, with the ceiling between 3,000 and 4,000 feet and a slight mist falling.

Jimmy went to the tower to check on the weather and I looked over the airplane I was to ride in. The P-38 has been described as "three bullets on a knife," and that's close enough when it's in the air with gear retracted. The "bullets" are the pod-shaped cockpit and the slim motor nacelles which fair back into the characteristic twin booms of the Lightning's tail. The knife is a razor-like wing that helps give this fighter its sensational performance. Halfway back are the bulging Prestone coolers, and clear aft are the twin, elliptical rudders, spaced by a long, thin horizontal flipper. Right now she stands on her three-legged landing gear, looking like a recalcitrant broncho, but ready to go. Her sister planes on the line have concentrated lead-tossing trouble sticking from their bullet-shaped cockpit noses,

Pilot James Mattern and author. "Piggy-back" passenger occupies radio's usual spot on main spar.



A 5,000 f.p.m. rate of climb, full maneuverability on one engine, speed in excess of 400 m.p.h. and landing at 80 m.p.h., are outstanding performance characteristics of the P-38. Note belly tank between nacelle and fuselage.

but our plane has had her guns removed to balance the weight of her passenger.

Mattern came back with a "go-ahead" and we climbed abord. My quarters were not exactly palatial. The radio equipment had been removed from its place behind the pilot's seat and I squeezed in. I had my harness on and snapped the parachute to it, sliding the pack behind my back. I couldn't sit on it because my head was already banging the canopy and I found I would have to remain stooped over for the entire flight. My seat was the main spar that runs clear through the ship, and the upholstering was a coat of paint. Mattern had his usual comfortable accommodations with an inch or so of headroom when sitting up straight, but then the P-38 wasn't designed to accommodate deadheads.

Visibility from the cockpit was almost perfect and Jimmy taxied out like you'd drive your car. The tricycle gear makes ground handling easy. A quick run-up of the engines, a crackle in Jimmy's earphones and a "Roger" from him to the tower in return, and we were set for take off. The canopy was closed and the engines revved up while Jimmy held the brakes on. There was a sudden rush, I clicked the stop-watch on my wrist, then looked up to see the airspeed reading 90 and winding right on up. As it passed the 100 m.p.h. mark Jimmy pulled the wheel back an inch and we literally leaped into the air with the gear moaning up into the wings beneath us and the air-speed climbing frantically. A DC-3 started across our course at our altitude, but we were 1,000 feet above it and a mile beyond it before I could tap my pilot on the shoulder and point. We finished one-quarter of our climbing circle of the airport and ran smack into a shredded, misty ceiling at 3,500 feet.

Jimmy stuck the nose down to stay underneath while we both looked for the few tiny holes. We dove under the stuff and both saw it at once—a tiny patch of blue sky almost above us. Back came the wheel, down went my stomach and up went the *Lightning* through the hole. A few seconds and 15,000 feet later we were on top of a world of cotton and climbing into the sunlight.

There was more to come, however! The nose tilted higher until it was pointing up at 60° above the horizon and the rate of climb read over 5,000 feet a minute! Jimmy half turned and said, "A mile a minute straight up" and I could well believe it as I was lying almost on my back, with my shoulders on my parachute pack, and being shoved upstairs by some 2,300 h.p. Far from faltering in the climb, the ship picked up speed. Every few seconds Jimmy hauled back on the throttles a little more, explaining that "the higher we go the more power we have with these turbos."

At 10 000 feet we square away for cruising. As nearly as I could tell we were 20 miles from the field and two miles above it somewhere over Santa Monica, and the stop-watch said four minutes and 50 seconds. The engines were barely pulling and there was so little noise that we could talk freely, but we were gobbling up space at an appalling rate. Jimmy adjusted the prop pitch and the nose went down into a dive. The sensitive altimeter started unwrapping and the air-speed went up to—well, let's say "over 400." Jimmy pulled back on the wheel gently, but in my hunched over position I found that I could not hold my head up. My mouth dropped open, my cheeks felt drawn and I felt five times as heavy in my seat as usual. The chandelle started at 5,000 feet and we rolled out at the top above 12,000 feet.

Then came a demonstration. The right prop was feathered, the engine stopped and we cruised along on one engine. We climbed, did turns with and against the dead engine and finally peeled off after a fast medium bomber that slid by underneath us just above the clouds. Leveling off about three miles behind, Jimmy let the P-38 lose all the speed of the dive while he commented that the bomber was a pretty fast airplane. I agreed and he said, "Watch this." On one engine we took out in pursuit and went by the bomber like it was hanging on a sky hook. Our plane rolled away in a steep bank and I squashed down into my seat again as I wondered how a gunner in combat ever keeps track of the enemy. I was too busy holding my head up to turn it around and look at the bomber.

The twin concrete ribbons of Sepulveda Boulevard flashed past through a hole in the clouds and I sang out our position to the pilot, who certainly did

(*Continued on page* 162)

THE AERIAL WATCH

Pilot Raymond C. Hegy (left) and aerial photographer John H. Holmberg check map-making flight plan.

by S. R. WINTERS

Photographs from U. S. Department of Agriculture

ALONG with their undisputed position on the battlefront, airplanes occupy a prominent place in the front lines of agriculture. Food production goals for 1943 have been tremendously increased to meet war needs, and the role which aerial photography is playing in saving time and manpower is creating a new chapter in the story of aviation's adaptability.

The 1943 crop area production goal is 95,000,000 acres, a four per cent increase over 1942. Potatoes are slated for an 11 per cent increase, or a total of 3,160,000 acres. To mention a few more important crops for 1943, which will be produced more efficiently because of maps made from aerial photographs, the planned national acreage of oats is 38,800,000 acres; barley, 18,000,000 acres; wheat, 52,500,000 acres; soybeans, 9,000,000 acres. The new importance of oil crops has developed a strong interest in peanuts, of which 5,000,000 acres are to be planted, an increase of 19 per cent; flax seed, 4,500,000 acres; a 15 per cent increase in acreage of long-staple cotton; 1,380,000 acres of rice.

The exactness of aerial photography, by means of which 90 per cent of the total area of the United States has been photographed, is enabling the Department of Agriculture to determine definitely the best land for the various crops. The Agricultural Adjustment Association has about 21,000 rolls of aerial negatives.

Aerial mapping calls for highly skilled flying on the part of the pilot. He must hold his plane at a constant altitude and keep on predetermined flight lines as he cruises back and forth for hours over a designated area. At the same time, he must maintain a steady speed if the photographs taken at intervals all through the flight are to cover the right section of ground and have proper overlapping. He must be constantly on the alert to note changes in his turn indicator, directional gyro, rate-of-climb indicator, etc. The skill of the pilot is an important

ON AMERICA'S FOOD

By checking actual measurements in enlarged photo against calculated measurements, accuracy of scale is ascertained.

Acreage of various crops, which show up plainly on aerial maps, is checked by planimeter. One square inch is equal to 10 acres of land.

Farmer (left) inspects air view of his farm in county agent's office. Aerial maps may provide basis for payment of crop acreage adjustments.

The Department of Agriculture has enlisted aerial photography as an indisputable means of determining what shall be planted—and where.

factor in eliminating tilt, which would distort the picture. Tilt, incidentally, is one of the most common causes for the necessity of repeating a mapping job—adding considerably to the cost.

The maximum efficiency of a flight crew is dependent not only upon individual skill, but also on teamwork and coordination between pilot and photographer. The latter, too, has a precision job to do. He must help eliminate tilt due to camera angles and make certain that exposures are being made at proper intervals to produce a uniform overlap between each pair of photographs. Because the consecutive prints overlap each other, shingle-wise, by about 60 per cent, and the parallel strips overlap each other by 50 per cent, there is apparently much waste. This is not true, however, because only the central section—the part in true vertical projection—can be used; the edges are distorted. Each picture has within its bor-

(*Continued on page* 164)

International

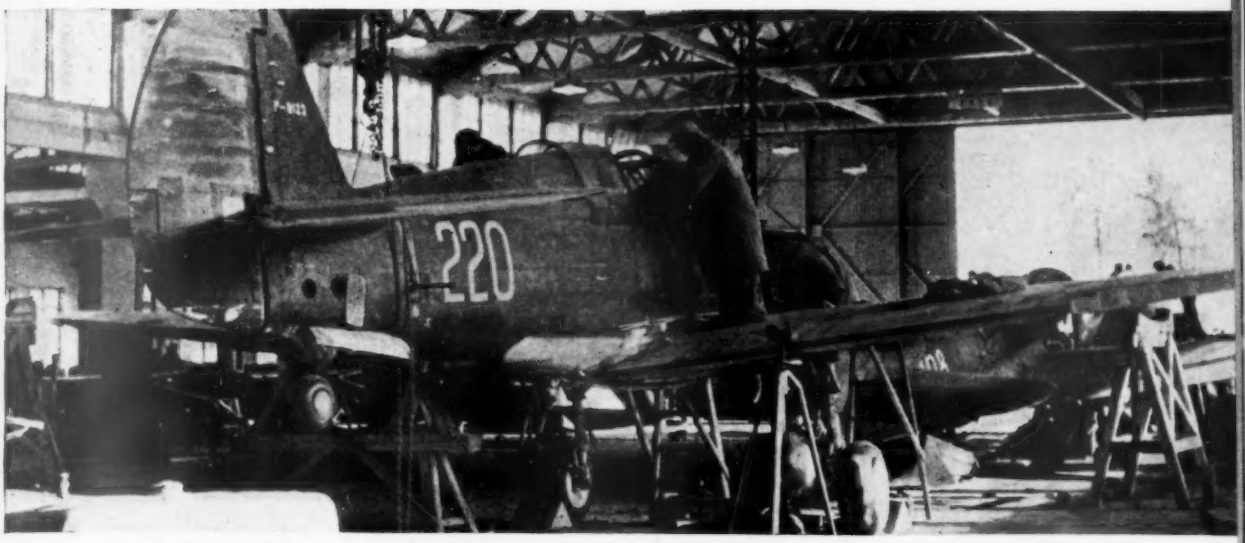
A few minutes after the fuses of these 500-pound bombs were set, they were loaded on P-40's bound for Jap bases in Burma.

How To BEAT THE

Here is a potent lesson based on the activities of one of America's leading aces in the Eastern theater of aerial warfare.

Acme

AAF mechanics in China give a Curtiss "Kittyhawk" an engine check.



Two Curtiss "Kittyhawks" are repaired by Chinese workers. Note makeshift maintenance and repair equipment.

JAPS IN CHINA . . .

By Maj. H. S. MAZET, USMCR

"I GOT my Distinguished Flying Cross the other day—have two more on the way, with two air medals—so I am liable to feel either very conceited or very lucky. My score now is 12; all confirmed. And six probables. These are all aerial victories, but take it from me I'd rather destroy them in the air any day than to have to strafe them in lines on the enemy fields when we must fly down through the Jap machine gun and rifle fire. They are bound to hit us once in a while. One time my oil line was shot away and I just got back home, with the gauge hovering around zero for the last 20 miles."

There you have fighting over China as it was just a short time ago, direct from one of America's aces, Col. Robert L. Scott, Jr., recently returned from leading the Blank Pursuit Group, 10th Air Force.

He was chosen for this task by Gen. Claire L. Chennault, former commanding officer of the immortal *Flying Tigers*, and Scott proved that the choice was no fluke.

Scotty celebrated his 34th birthday by hopping the Atlantic in a Boeing *Flying Fortress* en route to India and then ferried a Curtiss *Tomahawk* fighter into Northern Assam, India, where he began operating as a one-man, one-plane American pursuit force over Burma.

For two weeks he strafed Japanese ground forces in lone-wolf flights, and won a Silver Star for destroying a Jap plane and two supply trucks near Myitkyina. Four days later he knocked out a Jap antiaircraft battery near Lashio. Three times in one afternoon he attacked the Myitkyina air base, hitting the runway with a 500 pound bomb each time.

Alone, he raided Homalin on the Chidwin River four times in one day and, according to British accounts, Jap casualties that day ran into the hundreds. As second in command of the U.S. Army Air Forces on the Assam-Burma-China relay he shuttled almost daily over the "worst air route in the world" and at the Chinese terminus would jump into the cockpit of a *Tomahawk* borrowed from General Chennault, and join sorties with the AVG, during one of which a train and railroad sidings at Hanoi, Indo-China, were destroyed. Most of the AVG casualties were suffered in strafing missions of this kind, but in none of his raids did Colonel Scott suffer a scratch.

As a result of his aerial activities during May, 1942 (for continued bravery and exceptional gallantry over the enemy lines) he was recommended for the Distinguished Service Cross and corresponding Chinese decoration. Part of the citation reads: "He has made repeated flights in unarmed transports carrying explosives and other vitally needed supplies to Chinese troops. With these maximum loads of highly inflammable materials, he has been subjected to repeated enemy operation. These flights were made over extremely dangerous mountain terrain and through hazardous flying weather. In fighter and transports, he has flown a total of 214 hours during the month."

Two hundred and fourteen hours in enemy territory in one month! That record is as incredible as the man himself.

Scotty says of his exploits about that time, "In a fighter Curtiss *Kittyhawk* I acted as convoy to bombers in a raid on the big Jap air depot at Hanoi. They bombed it and on the way back I caught a troop column in the rain in a narrow gorge near Mantha. Got about 300 of them. I burned some trucks and then saw an observation plane on the ground. My guns put about 1,000 rounds in it in 30 seconds. It burned, and I have a movie of it. Incidentally, the only time I noticed their antiaircraft fire was while going back to take the pictures. I resolved never to go back again for pictures!"

Before it was disbanded, the AVG came to know Colonel Scott as a superb pursuit pilot, for he joined their sorties on the wing in their formations and burned up the sky with his tracers. Of that indoctrination period Scotty wrote, "There's something wrong with anybody who doesn't like this kind of life. The AVG out here have really done the greatest job of fighting the world has ever seen. More than 300 victories with a loss of 28 ships and nine pilots.

"While I was with them I made my first raid over Hanoi on the Emperor's birthday, and the second on May 5th, when we really hit that place.

"I burned a Jap train north of Haipong. I understand that the AVG may be ordered to duty with me.

Two more tiny Japanese flags were yet to be added to Col. Robert L. Scott's Curtiss "Kittyhawk" when this picture was taken. He recently returned to the U. S. from China.

My boss will be Chennault, the greatest tactical flyer I know of. I will count myself the luckiest man in the world of war and strife if such is the case. General Chennault told me the other day he has plans for us, so here's hoping!"

That is a masterpiece of under-hoping. Since the formation of the Blank Pursuit Group under Scott, the imperishable record of the valiant *Flying Tigers* has been stretched to incredible lengths, for many former Tigers are flying with the group. What Scott learned of tactics with the AVG, he put into practice with his own squadrons with the result that the air war over China immediately became one of brightest hope.

The American Air Force at once went on the offensive and hit the Japs time and again. On September 1, the pursuit squadrons rendezvoused over Hengyang, scene of successful air battles the previous month, and proceeded to the objective on the coast, in the straits of Hainan: 10 steamers towing supplies for the Nips, with three small gunboats as escort.

"We split into our groups," says Scotty, "each with a target for four planes and hit them as hard and as fast as possible. I saw my tracers eat into the steel side of one of the gunboats. I could see the glow of tracers mixing with the brighter light of heavy and medium antiaircraft coming at me. I held the trigger down until I went right over the smokestack. For the last 100 yards I was right down on the water firing *up* at the ship. Then, out of range, I turned left and hit the next boat. I saw the men going over the side; saw some of them hit as I aimed intentionally low, and the ricochettes were going into the hull just as good as the direct hits. I then spotted steam blasting from the boilers in a huge, white cloud.

"Over and over we went, each man making four passes on each boat. On one of them, I spotted an explosion of black smoke from oil, gasoline or the magazine. One boat sank as we made our second pass. The water was crowded with swimming Japs. The AA grew less intense as we shifted our attacks to fore-and-aft. The ships were swept clean and many were sinking. As I made my fourth pass I saw the boat I had first attacked going down. Only its stack and the Jap flag were showing. That flag burned into my soul. I pulled up into the nearest approach to a chandelle I could make in that situation and brought my sights to bear on it. A short burst of six 50's shredded it. I went over and headed for the other three planes in my flight. Over the side I could see the little group of gunboats and seven of the 10 steamers sinking or badly damaged.

"Then my real test began. As I gunned the Allison, I heard a peculiar pop-pop—pop-pop-pop. Mechanically I reached over to ease the throttle back, figuring that I was pulling too much manifold pressure and detonating. But it continued. Then with a skip of my old heart, I looked into the early morning sun coming up out of the Pacific. Oh man! I could see four winking red glowing lights even in that glare. Instinctively I knew they were the cannon of Zeros! My altitude was only 1,000 feet. I couldn't dive, so I suddenly swerved toward the two enemy aircraft, pressing the gun switch even before I brought the nose of my ship to bear. My six guns really spoke. In that reddish sun glare I saw, heard and felt the sharp explosion as my fire hit the leading Zero head on. I went through the debris, feeling parts of the exploded ship hitting me. I could taste the burned oil as I flew through it.

"When I flew away from there at top speed I lost the other Zero. Gee, but the green rice paddies looked good to me as I climbed to the cooling upper air.

"We refueled and struck again; then went on to another airfield to fluster the Japs, and in co-operation with the Chinese ground advance, we bombed one of their best fortified towns. Three missions in one day and five holes in my plane—with one tire flat from a cannon crease and enemy oil all over my windshield—I called it a day. Tex Hill with his squadron had hit sail junks loaded with rice and told of seeing the flames rise and burn the bamboo sails. Frank Schiel hit the coast defenses of the nearby port. Besides, we shot down four certain and two probable!"

That is the Army Air Forces in high gear. Other fights above other cities and ports continued. Meanwhile, Scotty took time out to test gun operation at high altitude and to fly a new fighter over the Himalayas. He actually flew over Mt. Everest at blank feet, from which vantage spot he could see hundreds of miles across the roof of the world, from Tibet and China far out into India.

The Blank Pursuit struck to the south in Indo-China on September 25, bombed Gia-Lam airfield at Hanoi, fired the docks at Haipong, shot down most of the 13 fighters which rose to the attack and damaged the remainder. Over in Burma these Yankee lads had cleared Jap trucks off the Burma Road with fragmentation bombs and strafing. In the Swansi and Hunan regions between Hengyang and Kweilin, they won mastery of the air with at least 50 victories! They hit Canton time after time.

But aerial photographs showed much shipping concentrated at Kowloon and Hong Kong, nesting in the blue waters of Victoria Harbor. Besides, the Jap had repeatedly boasted over the radio from Tokyo and Shanghai that all persons were safe in those former Chinese cities—the Americans could not bomb it. If they tried, bragged the Jap, all U. S. Army planes would be shot down long before they ever reached the Hong Kong area. Contemptuous, too, were they of Brig. Gen. Caleb V. Haynes, leader of the bomber group: "He's just an old, broken-down transport pilot," they chortled.

Suddenly, however, the Americans did bomb Hong Kong, in the first Allied action since the tragic fall of that city a year previous. Scotty led the fighters. He personally shot down two Japs and damaged four others; his squadrons destroyed 18 confirmed by the enemy themselves. And the fighters hit the intercepting enemy planes so savagely over Victoria Harbor that in two minutes the only planes in the air were our own!

Medium bombers under General Haynes led the assault. Each ship was loaded with 500-pound bombs, and in each bomb bay were thousands of propaganda leaflets saying in three languages, "Compliments of the old, broken-down transport pilot."

Scotty told me the details of this bril-

(*Continued on page* 96)

PROWLING 'CATS

An unusual, striking photograph of a squadron of Navy Grumman "Wildcats" in battle formation.

These exhaust-streaked Bell "Airacobras" are out on patrol, their 20 mm. cannon and .50 caliber guns ready for a fight.

Produced for the U. S. Navy as the "Buccaneer" and the RAF as the "Bermuda", the Brewster SB2A is a new dive bomber.

Airacobras Strafing Jap Air Base

SUDDEN DEATH...made in U. S. A.

They asked for it.

Axis gangsters took the miracle of aviation and made it a weapon of destruction. They bred their birds of prey, unleashed them—

Now they hear a tougher breed roaring overhead. Army Airacobras, made at Bell Aircraft, bringing sudden death.

In three years—starting from scratch—we Americans created the largest aircraft industry in all the world. Spotting our enemies ten years we are already outbuilding them. This is a record we can all take pride in.

★ ★ ★

When the world's skylanes are made safe for peaceful travel and commerce, the aircraft industry promises you planes advanced almost beyond imagination. We men and women who designed, engineered and built the cannon bearing Airacobra, will be ready for an important assignment. © Bell Aircraft Corporation, Buffalo, New York.

Airacobras for victory—

FUTURE PLANES FOR PEACE

BELL *Aircraft*

PACEMAKER OF AVIATION PROGRESS

Another sport plane gone to war is the Fairchild "Forwarder". This one is British; others are used by U. S. Army and Navy.

Highly popular in Canada as an advanced trainer is the North American "Harvard", similar to U. S. Navy and Army "Texan".

SHIPS PASSING . . . *day and night*

Today . . . tonight . . . huge cargo ships of the Air Transport Command are swiftly spanning oceans and continents on missions which are shaping the course of the war. Some are speeding urgently needed battle supplies and equipment; others are flying technicians, scientists, generals, to crucial fronts . . . to Africa, Australia, Asia, the South Pacific, Alaska.

Curtiss Commandos . . . the world's largest twin-engined transports . . . are a vital part of this history-making aerial fleet. They carry the goods of war today, but in the peacetime era of tomorrow they will help to revolutionize world commerce by shrinking global trade routes from weeks to days, from days to hours.

CURTISS-WRIGHT
Corporation
AIRPLANE DIVISION

FIRST
Since the Birth of Aviation

CURTISS *Commandos*

TRANSPORTING THE GOODS OF WAR

GAS STOP

During Army maneuvers in the South, this Piper "Grasshopper" landed at a roadside pump to refuel.

IN TIME OF WAR PREPARE FOR PEACE

In his first annual address to Congress in 1790, George Washington said, "To be prepared for war is one of the most effectual means of preserving peace."

Today, in the midst of war, his advice might well read, "In time of *war* prepare for peace." For peace, like war, has definite objectives—which should be planned in advance.

When victory brings peace, the contributions of industry no less than statesmanship, will help determine the kind of world we'll live in . . . and aircraft will play an important role.

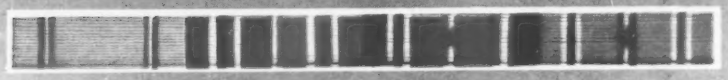
Right now, of course, war production is all important. At McDonnell, we're working three shifts making planes, parts, and plastics for our Armed Forces. But we're working too, toward the better aircraft and better materials which will be a part of tomorrow's better world.

McDONNELL *Aircraft Corporation*

Manufacturers of PLANES · PARTS · PLASTICS ★ SAINT LOUIS - MEMPHIS ★

LOCKHEED P-38 *LIGHTNING*

Campaigner



AMERICAN DEFENSE SERVICE *(PRIOR TO PEARL HARBOR)*

AMERICAN THEATRE CAMPAIGN *(OUTSIDE CONTINENTAL U. S.)*

EUROPEAN-AFRICAN-MIDDLE EASTERN CAMPAIGN

ASIATIC-PACIFIC CAMPAIGN

all with

ELECTRIC **CURTISS** PROPELLERS

American Airlines

AIRLINE FUEL CONSUMPTION

by Capt. M. G. BEARD

Marked savings in airline operating costs may result from a more accurate knowledge of fuel needs.

(Concluded from the May issue)

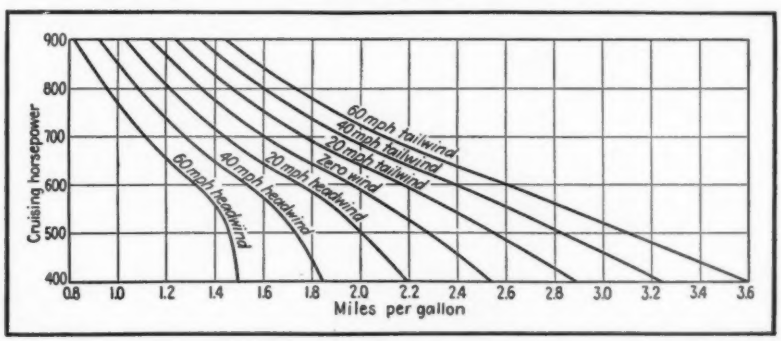
THE Cambridge analyzer became a reliable instrument as soon as installation difficulties had been ironed out. There are still some temperature errors which, at the present time, are being averaged but which may be eliminated in the future by a temperature compensated sampler unit. The present analyzer in use must be calibrated frequently for mixtures much below .070 fuel/air ratio. Therefore, if specific consumptions below .45 are desired in airline operation, another form of mixture control might be required. Engines and installations designed prior to 1938, usually have certain limitations in their ability to operate at mixtures below .070 f/a at 70 per cent power in transport airplanes whose cruising speed is less than 185 m.p.h. Therefore the exhaust gas analyzer still provides a convenient and reliable method for adjustment of the desired mixtures.

The efficiency of adjusting mixtures manually and depending upon pilots to adjust the mixtures, depends upon the alertness of the crew in changing the mixtures as flight conditions change and in their care in securing accurate adjustment of the mixtures and in regular and careful servicing of the exhaust gas analyzer. With this system, carburetor basic settings are usually a little richer than desired except for take-off power where the mixture is set for minimum desired in order to decrease the power loss with mixture controls in full rich positions. When both members of the crew are busy during bad weather with their navigation and radio contacts, mixture adjustments are inclined to wait until a suitable time before adjustments are made. If hurried, the pilot is inclined to leave the mixtures richer than necessary during climb in order to protect the engines from damage under conditions when he does not have time to attend to the adjustment with precision.

Flowmeters indicating directly in pounds of fuel consumed per hour have been developed within the last two years and give reasonable accuracy. Fuel totalizers have been used for several

(*Continued on page* 90)

Figure 1. Chart shows the cruising economy of DC-3 in fuel versus h.p.



AIRCRAFT RECOGNITION HINTS

by Sq. Ldr. S. W. GARDNER

Command Intelligence Officer, Royal Air Force

Ability to identify all aircraft, friendly or enemy, is vitally important in air war.

WITH the progress of the war, the subject of aircraft recognition has become increasingly important and, similarly, increasingly difficult, as there now are approximately 400 types of aircraft used by the Allied and Axis air forces. This condition is in sharp contrast to the opening days of the war when aircraft identification was comparatively simple. Insofar as Great Britain was concerned, the distance of enemy bases from England prevented other than multi-engined enemy aircraft from reaching London or other objectives across the channel. This circumstance naturally limited the number of foreign craft which had to be known on sight.

Both the Allies and Axis have modified earlier designs until there is not such a clear cut difference and in some cases there is great similarity. There is the classic instance of the pilot of a Messerschmitt Me-109 who shot down a Dornier over its own airport and upon landing at his fighter base phoned the bomber airport concerned to ask for confirmation of his victory!

With our 400 types of aircraft to consider and many similarities, the problem assumes gigantic proportions. Many methods of simplifying the problem have been suggested. Some of these methods have been almost as difficult to learn as the aircraft themselves, and therefore methods of recognition which in any way increase the number of items to be remembered, should be avoided.

Every possible means should be taken to cut down the number of aircraft to be studied, and while it is not considered impossible for the normal mind eventually to identify and remember 400 types of aircraft, yet to attempt this all at once can only lead to chaos.

Therefore, some method of elimination is necessary. This is best done by considering that our aim is to be able quickly to recognize the enemy.

If we are able without fail to recognize the enemy, it is not necessary (though it will assist) to be able to identify friendly aircraft. For example, if we were on the police force and were charged with the responsibility of rounding up a gang of criminals, we should not study photographs of all the people on the earth to be able to identify the criminals. We should concentrate upon the criminals.

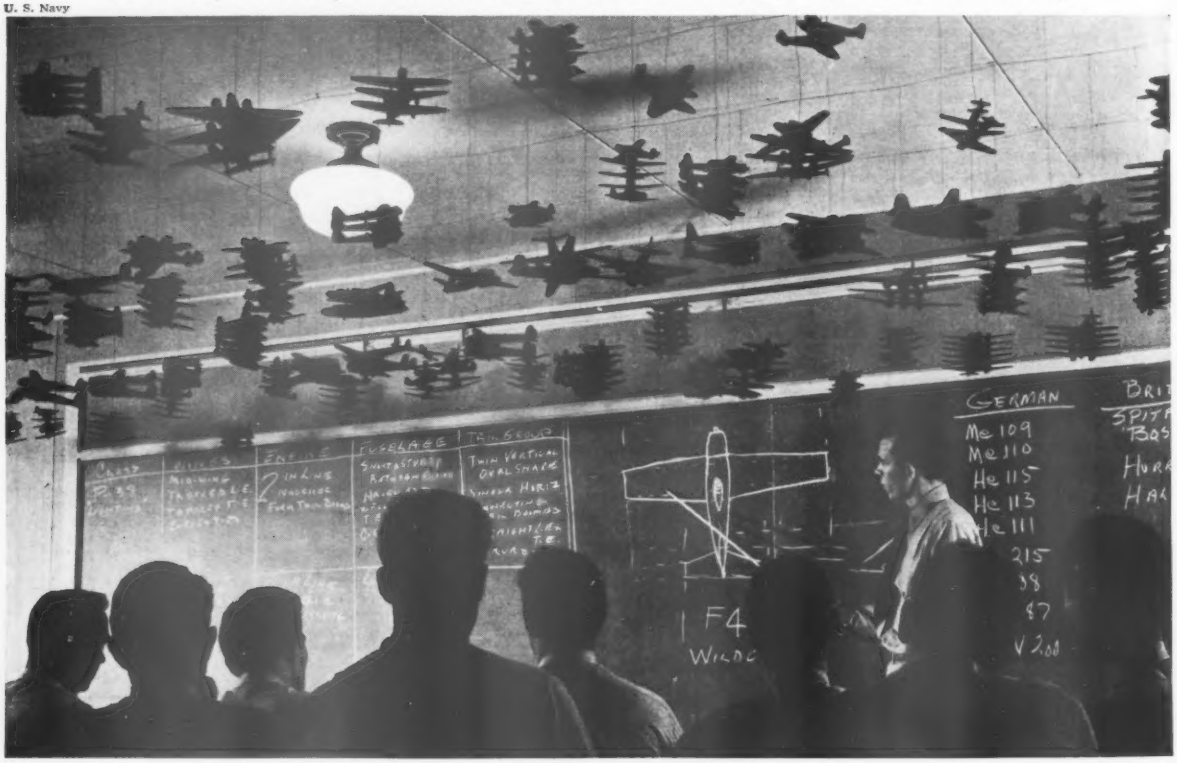
In view of the fact that the enemy has few types in comparison with the Allies, this procedure simplifies the problem and does not give the mind too large a number of aircraft to deal with at the outset. Therefore, concentrate upon *knowing the enemy.*

If we also take into consideration the area in which we are operating or likely to operate, the number of aircraft to be

(*Continued on page* 169)

A U. S. Navy aircraft recognition class studies salient points of Grumman "Wildcat." Models are for detailed study.

U. S. Navy



FOR IDENTIFICATION

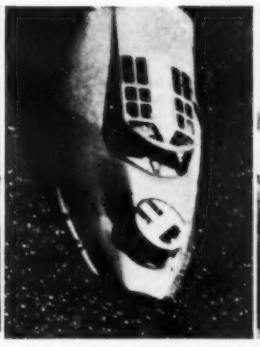
1

2

3

4

5



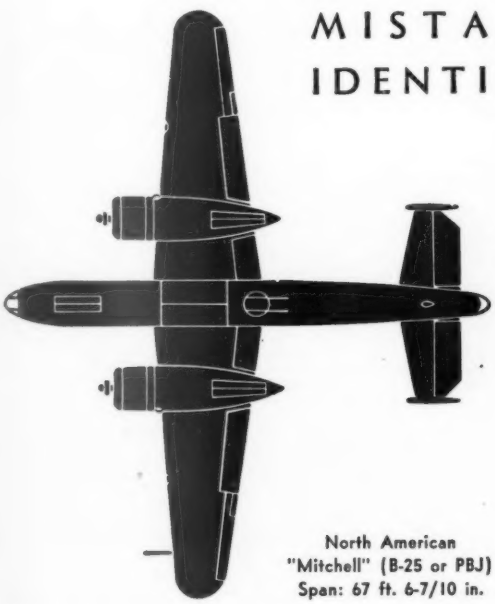
6

7

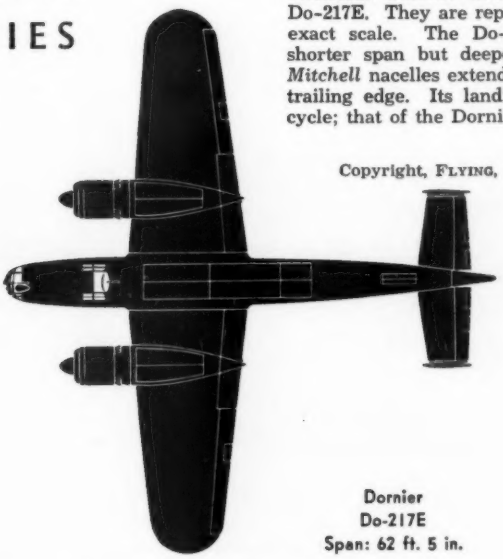
8

The planes are: 1. Fieseler "Storch" (Fl-156C). 2. Curtiss "Warhawk" or "Kittyhawk." 3. Avro "Anson." 4. Grumman or General Motors "Avenger" (TBF or TBM). 5. Republic "Thunderbolt" (P-47). 6. Consolidated "Catalina" (PBY). 7. Douglas "Bolo" (B-18A). 8. Martin "Mariner" (PBM-3).

MISTAKEN IDENTITIES



North American
"Mitchell" (B-25 or PBJ)
Span: 67 ft. 6-7/10 in.



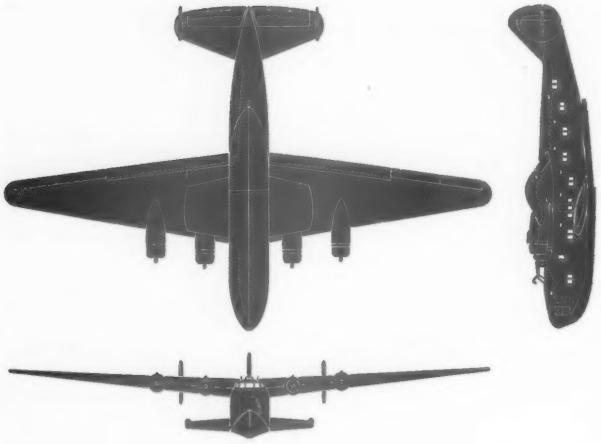
Dornier
Do-217E
Span: 62 ft. 5 in.

FREQUENTLY mistaken for each other are the bottom views of the North American *Mitchell* and the Dornier Do-217E. They are reproduced here to exact scale. The Do-217E wing has shorter span but deeper chord. The *Mitchell* nacelles extend back of wing's trailing edge. Its landing gear is tricycle; that of the Dornier conventional.

Copyright, FLYING, June, 1943

BOEING "314"

Transoceanic Flying Boat



PERTINENT FACTS: This is Pan American Airways' famed Boeing Clipper. It has been in regular operation across the Atlantic and Pacific oceans for several years. Some time ago the British bought some of these aircraft from Pan American for certain of their overseas operations. The "314" is a high-wing, four-engined flying boat monoplane. The engines are Wright *Double Row Cyclones*, each developing 1,550 h.p. for take-off. Span is 152 ft.; length, 106 ft.; height, 20 ft. 4½ in. Empty weight is 48,400 lbs., maximum gross weight, 84,000 lbs. Placarded top speed is 212 m.p.h., cruising is 180 m.p.h. Maximum range is slightly less than 5,000 miles. Total fuel capacity is 5,448 gallons; each hydrostabilizer or "sea wing" carries 1,164 gallons. The "314" carries a total of 89 persons; maximum passenger capacity (for short hauls) is about 84. For ordinary operations its maximum passenger load is 74 day passengers or 40 sleeping.

WHAT TO LOOK FOR: The high cantilever wing has moderate dihedral, equal taper and pointed tips. The four radial engines are directly on the wing's center line. The large flying boat hull is two stories high, the crew occupying the second floor. Large hydrostabilizers are fitted to the hull at the water line, directly under the wing. The tail unit has two rudders and a large vertical stabilizer between them, giving the appearance of being three rudders.

Copyright, FLYING, June, 1943.

LOCKHEED "CONSTELLATION"

Cargo and Transport

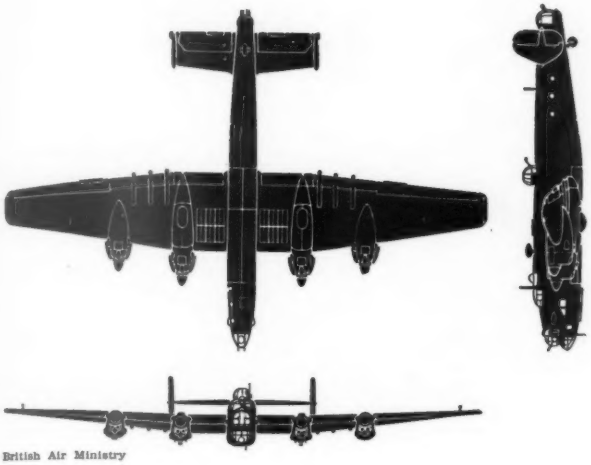
PERTINENT FACTS: Newest cargo plane to go into production for the Army Air Forces, the *Constellation* (Army designation C-69) was developed originally by TWA and the Lockheed company, only to be taken over by the Army. While little information has been released officially in this country, the March 12 issue of the British publication, The Aeroplane, contains the following data: Span, 110 ft.; length, 85 ft.; height, 18 ft. 8 in. Cruising speed, 280 m.p.h. at 25,000 ft., service ceiling 35,000 ft., maximum range, 4,000 miles. The Aeroplane article says the *Constellation* can maintain 25,000 ft. on three engines with a full load, and 16,500 ft. on two. The four engines are 2,000 h.p. air-cooled Wright *Double Row Cyclones*. As a passenger plane, the *Constellation* carries a crew of nine and 60 passengers. The fuselage is pressurized.

WHAT TO LOOK FOR: This low-wing monoplane has moderate dihedral and leading and trailing edge taper, with pointed tips. The engines are underslung below the wing and the main wheels of the tricycle gear retract fully into the inboard engine nacelles. In the side view, the fuselage has a slightly humped back. The tail assembly includes the well-known Lockheed twin rudders and a third stabilizing fin between them.

Copyright, FLYING, June, 1943.

HANDLEY PAGE "HALIFAX II"

Heavy Bomber



British Air Ministry

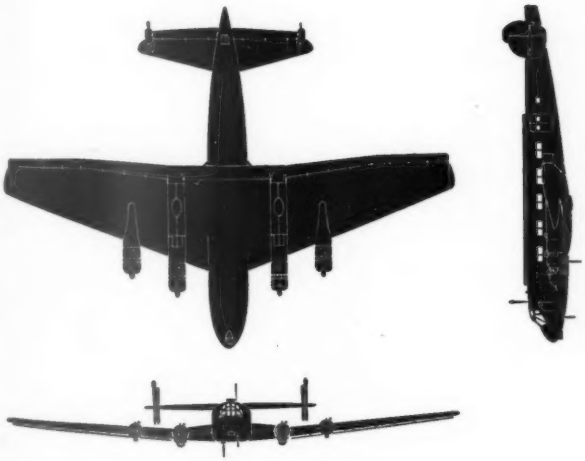
PERTINENT FACTS: One of the RAF's three staple heavy bombers, the *Halifax* is a mid-wing, four-engined monoplane in wide use by the RAF Bomber Command as well as the Coastal Command. Its engines are 1,175 h.p. liquid-cooled Rolls-Royce *Merlin XX's*. Built to an Air Ministry specification drawn up in 1936, the first *Halifax* was delivered to a squadron in 1940; its first combat flight was made on March 11, 1941. Wing span is 98 ft. 10 in. (wing loading is 50.5 lbs. per sq. ft.). Length is 70 ft. 1 in., height, 20 ft. 9 in. Maximum gross weight is 62,000 lbs.; empty it weighs 36,000 lbs. Normal range with a full load is 3,000 miles. It carries a crew of seven. Armament is eight to 10 .303 caliber machine guns.

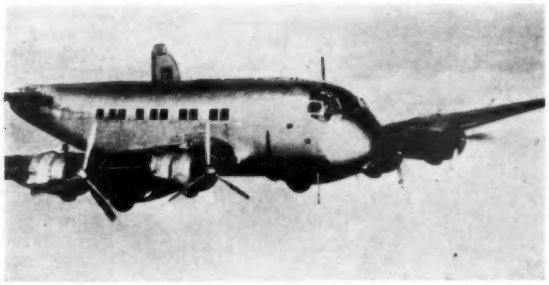
WHAT TO LOOK FOR: The thick cantilever wing has moderate dihedral from the flat, rectangular center section out to the tips. It also has equal taper with squared tips. The engine nacelles are underslung below the wing, the two main landing wheels retracting partially into the inboard nacelles. The fuselage is rectangular and deep. The tail has twin rudders. The tail wheel does not retract. There are power-driven gun turrets in the nose, tail and on top of the fuselage.

Copyright, FLYING, June, 1943.

JUNKERS Ju-90B

Cargo and Transport





PERTINENT FACTS: Originally an airliner, the Ju-90B has been seen at various German fronts as a troop-carrier and cargo plane. One of the largest of all German aircraft, the Ju-90B first appeared in 1938. Preceding models were powered with liquid-cooled engines; the Ju-90B is fitted with four 880 h.p. BMW air-cooled radials. These give the airplane a top speed of 236 m.p.h. with a full load. Gross weight is 51,000 lbs. Span is 114 ft. 10 in., length 86 ft. 3 in., height, 21 ft. Wing area is 1,800 sq. ft. Normal range is slightly less than 1,000 miles. British sources say some of the airplanes were exported to Japan.

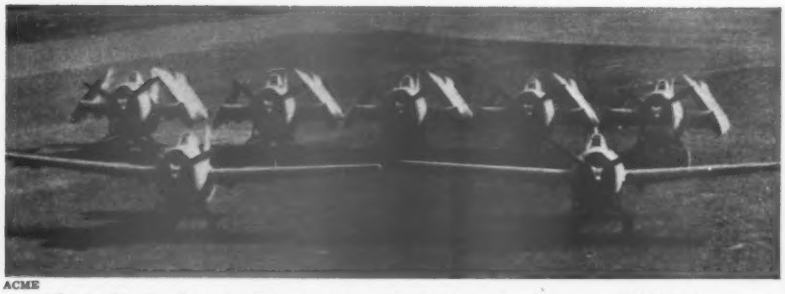
WHAT TO LOOK FOR: The low cantilever wing has slight dihedral and an unusually large amount of leading edge taper. The center section is thick at the fuselage, tapering down to the inboard engines. The fuselage is square-shaped, is straight on top, tapering toward the tail on the bottom. There are twin rudders. Ailerons, flaps, elevator and rudders are of the Junkers "floating" type.

Copyright, FLYING, June, 1943.

U.S. NAVY-ACME

These Army Curtiss "Warhawks" recently were delivered overseas by a U.S. Navy carrier. Note partially lowered flaps for increased lift. Belly tanks give these aircraft the necessary range to permit them to reach airports near the fighting fronts.

HAVE YOU SEEN?



ACME

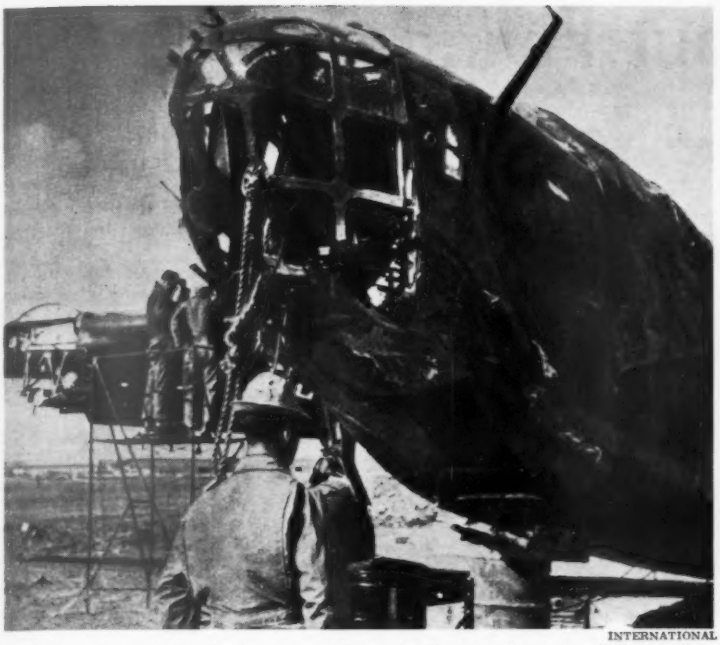
Like its big brother, the "Avenger" torpedo bomber, the Grumman "Wildcat" now has folding wings for carrier storage. Five "Wildcats" fit within wing span of two.

This photograph, from an enemy source, reportedly shows "an American bombing plane downed over Tunisia." Actually, the plane is a Lockheed "Lightning" (P-38).

INTERNATIONAL

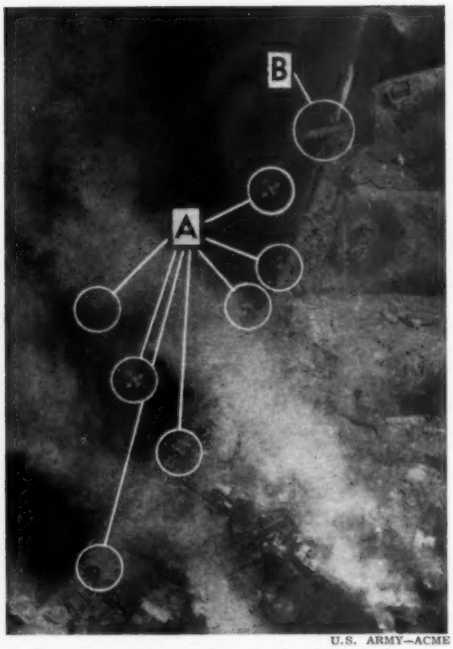
U.S. ARMY-ACME

Newest Army aviation award is this Air Medal, which is given in cases not quite meriting a Distinguished Flying Cross.



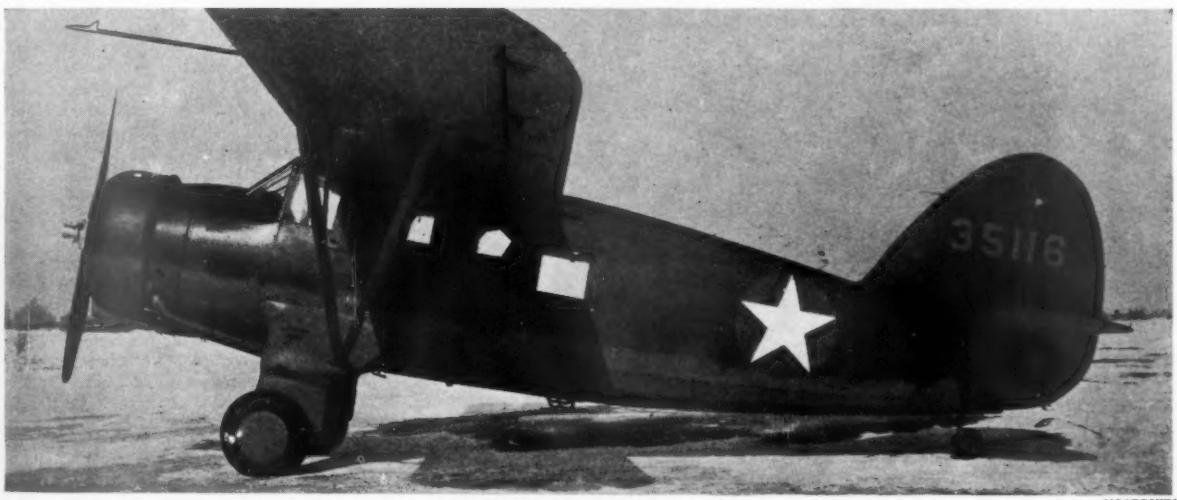
INTERNATIONAL

Shot up by antiaircraft during a raid on the Tunisian front, this "Liberator" flew home. The damaged nose wheel of the tricycle gear collapsed and the giant skidded along on its fuselage. Service crews are rebuilding it for further use.



U.S. ARMY—ACME

This reconnaissance photograph of Kiska shows seven Jap Zero seaplanes (A) wrecked or damaged, and a wrecked four-engine flying boat (B).



NOORDUYN

Designed for cargo and transport work as far north as the Arctic Circle is the Noorduyn UC-64 (Utility Cargo No. 64), built in Canada for the U.S. Army Air Forces. Gross weight is 7,400 lbs., wing span 51 ft. 6 in. Engine is 550 h.p. Another new cargo type is Cessna "Loadmaster" (below). A short-haul freighter, each engine is about 600 h.p.

CESSNA

I Learned About Flying From That!—No. 46

By W. F. BETTWY

Cold, a pair of muddy flying boots and a green student taught this pilot a lesson.

IT happened on one of those routine days of Army primary flying—the only difference being that it was an exceptionally clear day; visibility and ceiling unlimited; ground temperature about 35°; and the ground was covered with a sloppy ice crust that was thawing. The last two days had been filled with intermittent freezing rain.

One of the duties that come under my jurisdiction as flight commander is that of checking the flying progress of each of the aviation cadets in my flight. On this particular day I had five check rides to give and I was anxious to get under way. I handed the list of names to the dispatcher and asked him to have the cadets report to my airplane as soon as possible.

Little did I realize as I walked across the ramp with parachute hung over my shoulder that I was in for an unexpected lesson that would take a long time to forget—but a lesson that I do not *want* to forget as long as I continue flying.

As luck would have it the airplane was parked some distance off the ramp—in the mud. Slithering and slopping through the mud and ice with my heavy winter flying boots, I finally reached the plane and the cadet with whom I was to ride.

"Aviation Cadet Smith, J.D., reporting as ordered, sir. The gasoline tanks are almost empty. Shall I call the gas truck?"

"I doubt whether the gas truck can get to us in all this mud, Mr. Smith. You get the airplane started and taxi up on the ramp. I'll go get the gas truck."

Back through the mud and ice I walked until I was again on the ramp where I managed to get the gas truck to service us. It wasn't long before we were ready to get under way.

I had to walk into the mud again as I walked around the wing toward the cockpit. It took a great deal of strength to hold on to the fuselage handle, to keep me from slipping off the cat-walk and falling on my face. Somehow I managed to get into the cockpit.

The engine was started and we were at last under way. As we taxied out to the take-off position I gave Mr. Smith his orders over the gosport:

"Mr. Smith, take-off and leave traffic. Climb to 2,000 feet and give me a steep turn to the right and left; two chandelles; two complete lazy eights; a series of power-on stalls; and a two-turn spin. After completing these maneuvers return to the field and land. Any questions?"

He shook his head, indicating that he understood his assignment. I sat back comfortably and told him to go ahead.

During these progress rides I do all in my power to ride, hands off. The student does all the flying; I sit back and

(*Continued on page* 179)

Bottled Power

By Howard W. Blakeslee

THE fizz of our soda pop, liquid carbon dioxide, has become a midget power plant in war.

A fighting plane crashes at sea; power dead, electrical lines gone, hydraulic systems smashed, stunned crew barely crawling out as the water slips over the sinking ship.

At that instant, a door lifts on the fuselage, against even the weight of water flowing over it. Out of the opening fairly leaps a rubber boat, inflated, equipped, ready.

No one even presses a button. It is all automatic, and all done by one small bottle of carbon dioxide, which has lain for weeks in its packing back under the barely noticeable door.

Here is what happens:

Water, flowing into the fuselage, causes a switch to open the fizz bottle's nozzle. The outrushing bubbles first furnish the power which lifts the door; then they inflate the rubber boat. Buoyancy of the craft does the rest, does it so suddenly that aviators call the boat the "pop out" raft.

This boat is no toy. It has equipment; and men have sailed its like for weeks.

The robot bottle is metal. Its contents are carbon dioxide compressed to liquid. When it opens, 30,000 foot-pounds of energy flows out for every pound of liquid. Carbon dioxide is the most compressible of all gases, and hence packs the most power by the compression method.

Small bottles of the fizz also do three other power jobs on planes in emergency. In each case the bottle substitutes for hydraulic operation.

One of the most important of these is to open the bomb doors. They may jam, hydraulic systems may be shot up. Press a button and the fizz does the job so the bombs can drop on time.

Many crashes have occurred due to inability to lower landing gear, usually hydraulically operated. Other landing accidents have been due to failure of brakes to operate. The carbon dioxide bottles do both in emergency.

This midget power is only the newest job of carbon dioxide. There are scores of others, so many that Walter Kidde & Company, which makes much of the equipment, has expanded to a point where its working force has increased 600 per cent.

The emerging gas expands to 450 times its volume in the bottle. The aviator who has to bail out over water carries a flat parcel the size of a briefcase, with a metal tube 10 inches long and two in diameter. While dangling under the chute, the aviator turns a valve in this cylinder and the brief case blooms out, before he lands, into a fully inflated rubber boat.

Two cigar-size cylinders attached to his rubber "Mae West" vest will, whenever he chooses, inflate that garment into a life preserver.

If he fails to make the "pop out" raft, and his brief case boat is also gone, he is still not quite out of reach of rescue by

(*Continued on page* 77)

Flying Cavalry

"FLYING CAVALRY!" This is no idle dream. For the Piper L-4 plane has the qualifications to speed "flying cavalrymen" on surprise attacks against the enemy . . . behind their own lines!

A squadron of these Piper "Grasshoppers" would play havoc with enemy communications, ammunition dumps and vital installations. Their remarkable maneuverability, their ability to land and take-off quickly from small areas and their unusual economy well adapt Piper L-4 planes for this and similar wartime uses.

Already, these stout little planes have proved their worth on the battlefronts of the world. And, when victory is won, a smart peacetime Piper Cub will carry you quickly and economically on vacation and business trips. Then, small airports and highway landing strips will dot the country . . . and light airplanes will dominate the sky, just as popular-priced automobiles dominate the road.

16mm. SOUND FILM—"The Construction of a Light Airplane" now available. For point of nearest distribution, write the producer: Supervisor, Audio-Visual Aids, Extension Services, Pennsylvania State College, State College, Penna.

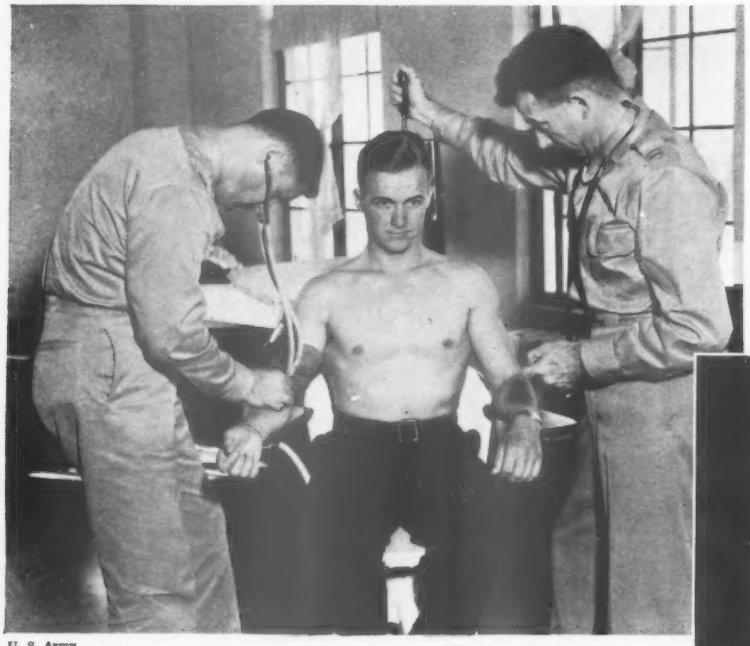
FREE BOOKLET ON HOW TO FLY. Send today for your copy of the easy-to-understand booklet "You, Too, Can Fly!" If you also want the full-color Piper catalog, enclose 10c in stamps or coin for postage-handling. Piper Aircraft Corporation, Dept. PA63, Lock Haven, Penna.

PIPER *Cub*

POINTS THE WAY TO WINGS FOR ALL AMERICANS

Have You Been GROUNDED?

By
SEDLEY PECK

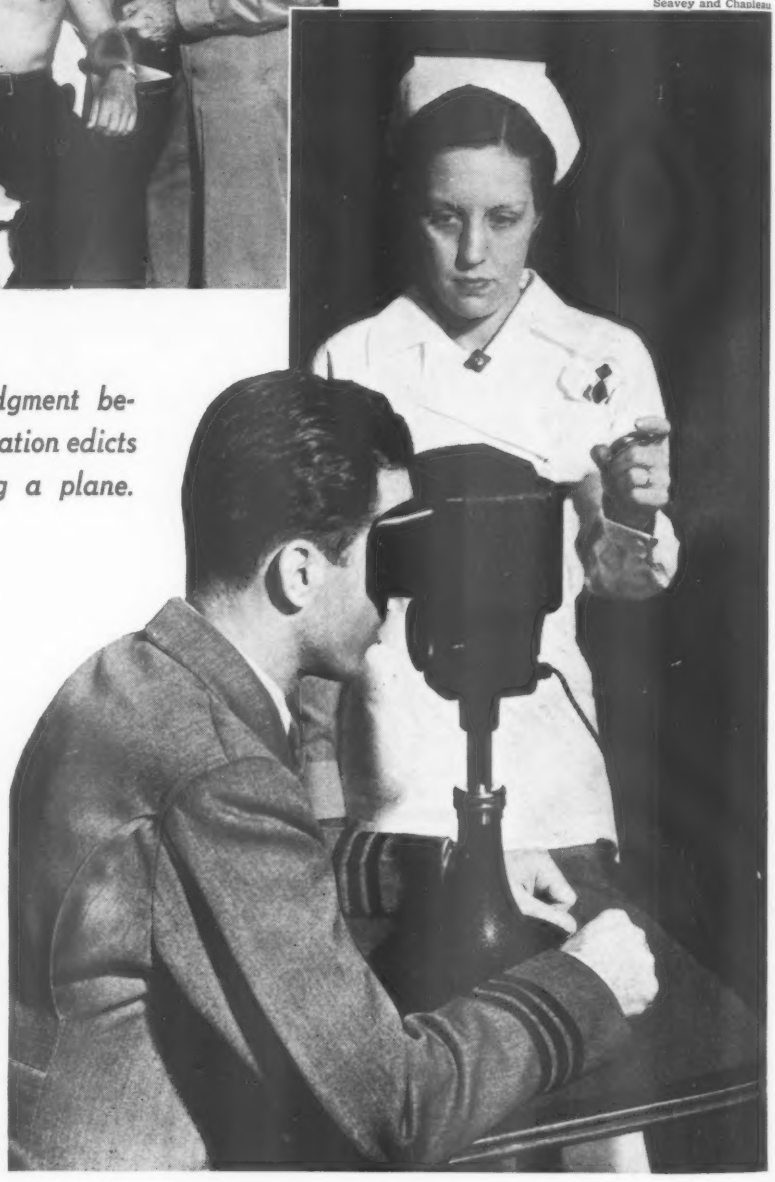


U. S. Army

← Physical balance, and this aspiring flyer's heart are being checked by flight surgeons.

Eyes are of prime importance to pilot. This device tests night visual acuity.

Seavey and Chapleau



There is sage and liberal judgment behind Civil Aeronautics Administration edicts that keep a man from piloting a plane.

"GROUNDED!" The toughest word in the airman's language. It calls forth all of the colorful invective known to this profession, and applies the choice collection of vituperation to the individual or authority which has called the turn of the unwelcome card.

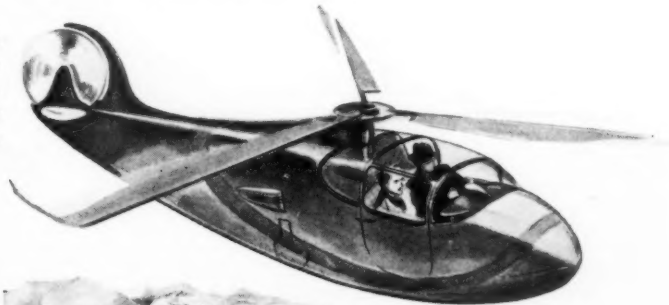
In 90 out of 100 groundings, the flight surgeon is the one who has said, "No! No!" And in 88 of these cases the "sawbones" involved has merely read the inevitable score. The "I was robbed!" wail of the wing-clipped birdman comes from a very few throats, but it is loud and insistent and merits investigation.

Down in Washington to the office of the medical director of the Civil Aeronautics Administration, Dr. William R. Stovall (himself a flight surgeon) goes every report of physical examination made by the 900 general practitioners and 400 ophthalmologists who have been designated by the medical director as competent to perform these examinations. There were 193,000 such examinations in 1942. A total of more than 500,000 individual airman records are on file, many of these showing biannual examinations since 1926

"**WHEN WE'VE TAKEN** care of Goering's boys, I'm going back to West Virginia and get me a little farm. But I won't be holed-in like the old folks were. I'll have my own plane . . . maybe one of those helicopter jobs they're talking about that can go straight up and down and land in the back yard. Then I'll be able to hop into town, or across the country, any time I want to. With the right kind of instruments, I'll be as free as the air I fly through. And, brother, that's for me!"

WHAT THE PLANE OF TOMORROW *will look like, or how it will perform, we don't exactly know. But we do know that Kollsman research engineers are constantly planning and developing new and better precision aircraft instruments . . . to help smooth out tomorrow's skyways, and give safer wings to a nation at peace.*

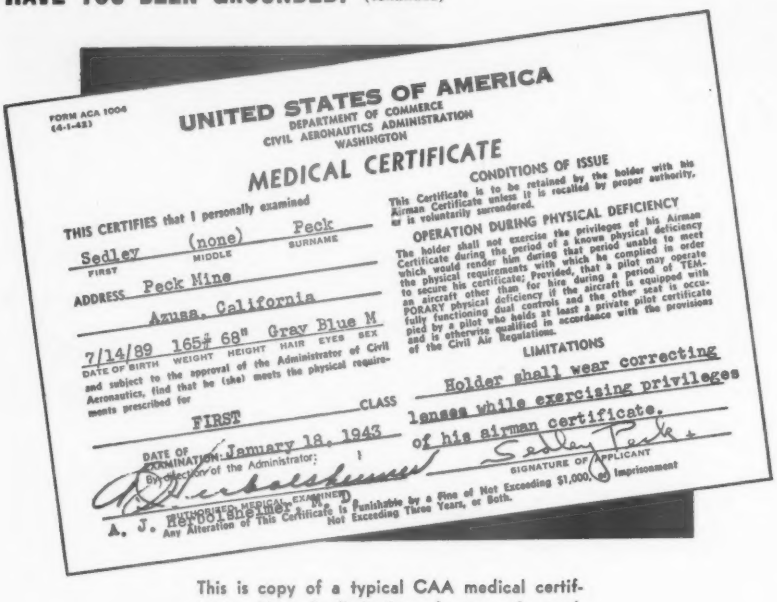
THE KOLLSMAN VERTICAL SPEED INDICATOR, *sometimes called Rate of Climb Indicator, is one of the basic instruments for maintaining level flight and for showing the rate of change in altitude. Though highly sensitive, the Vertical Speed Indicator can "take it", even in a power dive.*



KOLLSMAN
AIRCRAFT INSTRUMENTS
Product of
SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

HAVE YOU BEEN GROUNDED? (continued)



FORM ACA 1006 (4-1-42)

UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON

MEDICAL CERTIFICATE

THIS CERTIFIES that I personally examined Sedley (none) Peck (FIRST, MIDDLE, SURNAME)
ADDRESS Peck Mine, Azusa, California
7/14/89 (DATE OF BIRTH) 165# (WEIGHT) 68" (HEIGHT) Gray (HAIR) Blue (EYES) M (SEX)
and subject to the approval of the Administrator of Civil Aeronautics, find that he (she) meets the physical requirements prescribed for FIRST CLASS
DATE OF EXAMINATION: January 18, 1943
By direction of the Administrator:
AUTHORIZED MEDICAL EXAMINER
A. J. Kerr Shelmer, M.D.

CONDITIONS OF ISSUE

This Certificate is to be retained by the holder with his Airman Certificate unless it is recalled by proper authority, or is voluntarily surrendered.

OPERATION DURING PHYSICAL DEFICIENCY

The holder shall not exercise the privileges of his Airman Certificate during the period of a known physical deficiency which would render him during that period unable to meet the physical requirements with which he complied in order to secure his certificate; Provided, that a pilot may operate an aircraft other than for hire during a period of TEMPORARY physical deficiency if the aircraft is equipped with fully functioning dual controls and the other seat is occupied by a pilot who holds at least a private pilot certificate and is otherwise qualified in accordance with the provisions of the Civil Air Regulations.

LIMITATIONS

Holder shall wear correcting lenses while exercising privileges of his airman certificate.

Sedley Peck
SIGNATURE OF APPLICANT

Any Alteration of This Certificate Is Punishable by a Fine of Not Exceeding $1,000, or Imprisonment Not Exceeding Three Years, or Both.

This is copy of a typical CAA medical certificate. Note the limitations clause on the card.

—practically all of them showing multiple examinations.

There are 125,000 active medical certificates held by pilots and other airmen at the present time. A medical certificate okays the holder as meeting the minimum physical standards for certification at the time of issuance, and no person may utilize an airman certificate legally unless he holds a proper medical certificate issued within the preceding 12 months—except in the case of air line transport pilots who must renew within each six months.

The occasional pilot who fails to get by the medical examiner may wail—but he will not fly again until he can secure the medical certification of his category. A grounded pilot may appeal to the Civil Aeronautics Board and demand a public hearing which will be held at a place near his home and at a time agreeable to him; and as a final gesture he may invoke civil court action to compel the issuance of the medical certificate. This latter recourse has never been used, but it is a part of the airman's "Bill of Rights."

Dr. William R. Stovall is medical director of the CAA. To him come the medical reports of 900 general practitioners and 400 eye specialists who examine flyers.

This power to ground a pilot by refusing to issue or renew the medical certificate is the "arbitrary power" which is the basis of complaints by affected flyers. These "squawks" from men who have claimed that their means of livelihood, or their method of transportation, or their favorite recreation were being denied to them, may hurt aviation. It is, therefore, in order to examine the present law on the subject, and the present system of application of the CAA regulations.

Prior to the Civil Aeronautics Act of 1938, "An Act to create a Civilian Aeronautics Authority, and to promote the development and safety and to provide for the regulation of civil aeronautics," there was considerable confusion in the matter of the licensing of civilian pilots. This Act gave a foundation for standardization, and in its most discussed Section 602 (b) set out the basic consideration of airman medical certification, viz.,—

> "Any person may file with the Authority an application for an airman certificate. If the Authority finds after investigation, that such person possesses proper qualifications for and is physically able to perform the duties pertaining to the position for which the airman certificate is sought, it shall issue such certificate containing such terms, conditions and limitations as to the duration thereof, periodic or special examinations, tests of physical fitness and other matters as the Authority may determine to be necessary to assure safety in air commerce."

There it is—in condensed form. The CAA writes the ticket as to what are the "proper qualifications" to be "physically able to perform" to "assure public safety." And the applicant for an airman certificate must meet specified minimum physical standards, or else he will be in the same situation as a man who has an automobile all gassed up and ready to go, but who has no driver's license.

The medical director is the umpire in the fundamental conflict between one pilot's right to use the air as he pleases and others' right to safety while they are in the same section of air or are on the ground. To prevent increasing chaos as aircraft and airmen became more and more numerous, regulations became a necessity—and these were welcomed by all except that type of fellow who resents the ordinances which protect him and his family from city traffic dangers, and hates the policeman who enforces those ordinances.

In the vast majority of cases the issuance of the medical certificate is routine in nature. A beginner who desires to take flying instruction, or a veteran in any category may apply at any regular airport or flying field. The applicant for physical examination has his choice of the 900 designated physicians at $6 fee.

If the field examiner's findings are fa-

(*Continued on page* 154)

Because air battles don't stop for night

HAVE YOU A PICTURE of what tonight will be in the skies over the world?

Every minute tonight, some squadron of young U. S. pilots will lift their wings from a darkened field. They're starting out with grim confidence.

It will help them if we at home get clear on where the stupendous U. S. air program now stands—and on the place where each of us can fit into that plan and help make it go forward faster.

As aircraft designers and engineers, the "Northrop group" is working night and day under that plan. Northrop submits here some facts on what's going on.

• • •

What kind of planes is the U.S. building? This is a new kind of air war. In it the old-style "all-purpose" fighting plane isn't good enough. Today, one new plane may be a champ at what are called "low altitudes". But *because* it's so good close to the ground it isn't good enough 5 miles up in the sky.

The way to be best near the ground, and up high, and every place in between, is to have many different kinds of pursuit planes. That's what America is creating day and night—ALL kinds—including improvements on fighters already battle famous and deadly new ones you've not yet heard about. And plenty of each kind.

It's the same with bombers. In some areas we need bombers that will carry "block-busters" thousands of miles and come back home safe. In other areas another kind is better—bombers that will carry still bigger loads but have less flying range.

So here again the answer is many kinds of bombers. That is what the U.S.A. is building—and at a speed no nation ever dreamed of before.

• • •

What can a person do to help? *Every rivet in an airplane costs about 3 cents to drive into place. There are 600,000 rivets in one four-motored bomber. So, when you buy an $18.75 war bond you drive 625 rivets. Maybe that's enough rivets to hold a wing in place after a Jap shell has torn it, enough to get some boys safe back to their field after a night in a war-torn sky.*

NORTHROP AIRCRAFT, Inc.

NORTHROP FIELD, HAWTHORNE, CALIFORNIA • MEMBER AIRCRAFT WAR PRODUCTION COUNCIL, INC.

FAST FLYERS

by JAMES MONTAGNES

The war was brought close to North America when this five-man bombing crew arrived at Ottawa 24 hours after taking part in raid on Saarbrucken.

MILITARY history was made by the Royal Canadian Air Force when a five-man bombing crew arrived at Ottawa just 24 hours after bombing Saarbrucken, Germany. Still in their flying suits which they had worn while laying their eggs on the German iron ore district, they stepped out of a big transatlantic *Liberator* bomber, having been almost continuously in the air for 29 hours. Their trip brought home to North America that by modern bomber the air war in Europe is only a day distant.

Thirty hours before arriving in Canada they had started from their British airport in a *Wellington* bomber for the Saar region with a load of incendiary bombs. They started at 11:15 p.m. (British time) Tuesday. Three hours later, at 2:21 a.m. (British time) Wednesday they dropped their bombs on Saarbrucken and photographed the damage. Another three hours passed before they were back at their base in Britain, at 5:45 a.m. (British time) Wednesday. They flew in another plane 150 miles to an RAF Ferry Command base, where they stepped into a transatlantic bomber transport. They made one stop in Newfoundland. At 12:10 a.m. (E.D.T.) Thursday they arrived at Ottawa, having flown 4,000 miles since they started on their bombing raid and in that time having had less than 90 minutes on the ground.

They were all youngsters, this Canadian bombing crew. Their average age was 21, and the youngest was not yet 20. They were not picked for any special job they had themselves accomplished, but as an average bombing crew of the RCAF. They were from all parts of Canada, and their arrival in the Dominion started a transcontinental air tour during which each member of the crew had a chance to be with his family. The announcement of the arrival was the first word their families had of their coming.

Skipper of the crew was Pilot Officer J. B. Higham, DFC, of Assiniboia, Saskatchewan. The navigator was Flight Sgt. S. C. "Siggy" Lee, of Kildoman, Manitoba. Wireless operator was Flight Sgt. Karl Sveinson, of Elfros, Saskatchewan. Sgt. Art Loach, 19-years-old, of Toronto, was front gunner, and Sgt. Don Morrison of Sherbrooke, Quebec, was the rear gunner. They had been on 22 bombing raids together in the previous three months, and while the Saarbrucken raid was not the most eventful in their thrill-packed aviation careers it was the most important for they had been told that when they got back they were going to fly to Canada.

"We came in on our target after the raid had been going for about 20 minutes," Pilot Officer Higham told reporters at the Ottawa airfield. "At that time the city was practically hidden by a dense smoke, but we located our target and dropped more than 3,000 incendiary bombs and a single 500 pounder to boot. Although it was difficult to be certain, we believe we hit the target. Then we circled for home."

It was their second trip to Saarbrucken and "we knew the way in." There were a few Nazi night fighters and an average amount of flak to contend with, but they came back from the raid without a scratch. They and the nearly 300 other bombers taking part in the raid left Saarbrucken "burning like a circus."

They have all had adventures. Veteran of the quintet is Sgt. Don "Four Guns" Morrison, 20 years old, who has been in 36 raids and and has one plane to his credit. He got official citation for downing a Messerschmitt Me-110 over the North Sea, returning from a raid on Bremen. "I didn't see this guy until he was about 150 yards away," he explained. "He fired first, but he missed; I didn't miss."

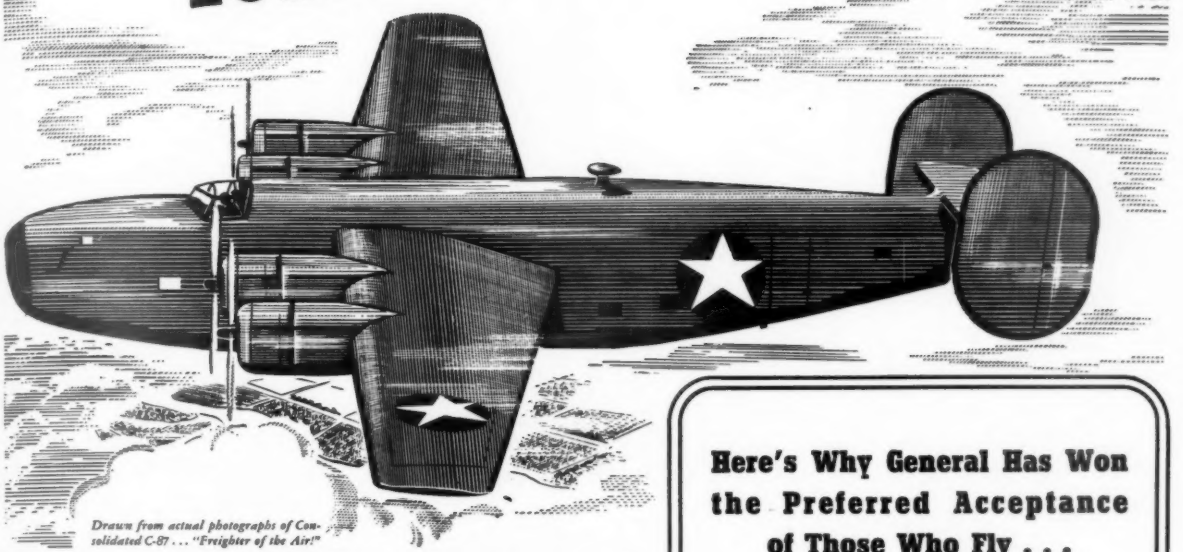
Sergeant Loach, aside from dropping 150,000 pounds of bombs ranging from incendiaries to two-ton block busters, also has official credit for a probable. This was over Germany, just after the bomb load had been dropped, when a German fighter came up on their flank, did not notice the Canadian plane, and was caught off guard by Art's first burst which caught him from below and shot the rear elevators off. "The skipper should get credit for that one," young Loach stated. "He maneuvered me into a position where I couldn't miss." When last seen in the dark of Germany's blackout, that plane was afire and falling.

In all their stories, each gave credit to the others. The *Wellington's* captain, Pilot Officer Higham, was awarded the DFC when he brought his ship back from Dusseldorf early in August, with one engine on fire. He shut off the flaming engine and flew home on the other, made a belly landing, and the crew stepped out

(*Continued on page* 94)

Landing on Canadian soil in a "Liberator" bomber, these young RCAF men completed 29 hours and 4,000 miles of almost continuous flying.

DELIVERING BOX-CAR LOADS OF FREIGHT...



Drawn from actual photographs of Consolidated C-87 . . . "Freighter of the Air!"

demands TIRES designed for the job!

This huge Consolidated C-87 cargo plane of the Air Transport Command is a cargo version of the famed B-24 *Liberator* bomber. These C-87s, *Freighters Of The Air,* "truck" complete hospitals to Alaska, personnel to England, tank parts to Africa . . . often passing through a temperature range of from 160° above to 60° below on a single flight!

Naturally, a C-87's tires take a beating. Tremendous weight at high speeds on Alaskan ice or baking hot desert sands *demands* tires built to stand up . . . *built for safety!*

And, just as General's truck tires lead on the highway . . . the General Airplane Tire leads on the runway! Yes, the reason is the same . . . General Airplane Tires are designed and built to do their job safely and well . . . on the basis of long, practical experience in the manufacture of airplane tires. That's why you'll see Generals on many types of military trainers . . . on fighters, bombers, cargo ships, commercial transports and on light, privately owned craft. *Remember, flyers everywhere depend on Generals!*

KNOWN AROUND THE WORLD FOR QUALITY AND SAFETY

Here's Why General Has Won the Preferred Acceptance of Those Who Fly . . .

1. Built to Military and CAA specifications by experienced airplane tire *engineers.*
2. General's *Rayon Cord* means less weight, greater payload. More strength, resistance to impact and heat!
3. Dangerous static electricity, built up in flight, is grounded out the moment a General touches the ground . . . thanks to General's electro-conductive construction.
4. There's a QUALITY General for every type of ship.
5. The same skill . . . craftsmanship and highest quality standards that have always characterized *Generals* are incorporated in the General Airplane Tire.

See Your Fixed Base Operator or Write—

THE GENERAL TIRE & RUBBER CO.

Aviation Division • Akron, Ohio

Piper

FROM L-3 TO P-47

Carl Bellinger.

by LEW TANSKY

Although test pilots usually work their way up through successively higher power ratings, Carl Bellinger went from 60 to 450 h.p., then up into the 2,000 h.p. class.

CARL A. BELLINGER took up a Republic *Thunderbolt*, the fleetest hunk of air-going TNT flying today. He cruised the snub-nosed fighter over the Long Island countryside. Then, after dragging the Republic field at Farmingdale, he came in.

He leveled off at six feet, and came down. He came down hard, fast and bumpy.

"I came down with everything but the mumps," he remarked apologetically.

To one onlooker, the landing was nothing to be smiled off. "What's the last thing you've flown," he asked with a bit more than a trace of sarcasm, "a Piper *Cub?*"

Carl was surprised. "Yes," he replied, and walked on to the Republic flight office.

The implication that Carl jumped from a 60 h.p. Piper to a 2,000 h.p. streak of lightning is not true, but the spread is not much greater. Before he grabbed the hand hook of the formidable P-47 and snuggled into the cockpit, he had piloted a 450 h.p. Stinson at approximately 160 m.p.h. The spread, then, is 1,550 in horsepower and 240-plus in m.p.h., the plus being a military secret.

Bellinger's feat is a far cry from the Yale man who occasionally cut his last class so he could fly to Long Island to have dinner with his mother. It's a far cry from the man who came back to Republic seeking a letter of recommendation to help him become a primary flight instructor. His first P-47 flight, successful enough, despite the misjudgment, to assure subsequent ones, stamped him as another stick artist qualified to put the *Thunderbolt* through its stringent test paces before it is delivered to the U. S. Army Air Forces.

Carl is a "Down Under" product. After spending the first year of his life in his birthplace, Cobar, Australia, he was taken by his parents to Chile, where he remained until he was six.

Then he was brought to the United States, where his father, Herman C. Bellinger (who afterwards became vice-president of the Anaconda Copper Company) came to seek new opportunities in the field of metallurgical engineering.

It was in November, 1928, that Bellinger

Production test flight of "Thunderbolts" is part of Bellinger's everyday work.

Republic Aviation

Piper

ough

vent

lass.

uct. After
ife in his
vas taken
e he re-

e United
n C. Bel-
ne vice-
per Com-
unities in
eering.
Bellinger

.

olic Aviation

There will be thousands of them pouring down from the sky. They're Yank Paratroopers—"Devils from Heaven"—who are rough and tough enough to be more than a match for any German or Jap—any size.

What makes these flying Yanks tough is their thorough training under master technicians who know how to fight. And what makes them still more formidable enemies is their modern equipment—the finest in the world.

AIRCHOX COMPANY, Division of

JOYCE AVIATION, INC.

General Offices, 8 So. Michigan Ave., Chicago

MAKERS OF THE WORLD'S FINEST PARACHUTE AND BELT HARDWARE

PERFORMANCE CONTROLS THE AIR

Consolidated Liberator

PESCO Fuel Transfer Pump widely used on American aircraft

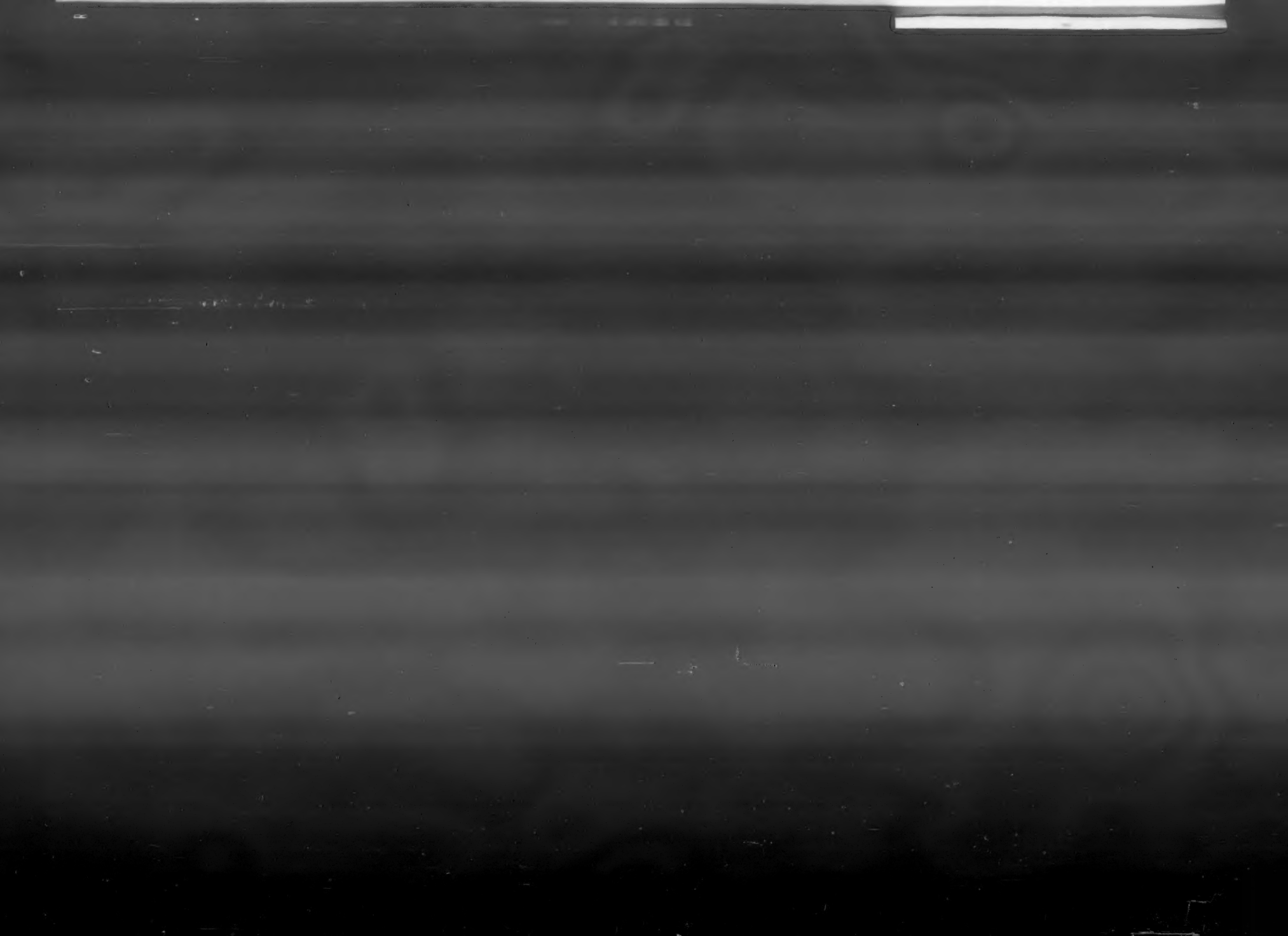
The Berlin radio was silent last night. This morning we know why. *The Yanks again!* What a performance record these big war birds are setting for going places, doing things, and coming home. It's precision exemplified. That's the inspiration of every worker here at home, to make every plane part a model of precision.

In Aircraft Hydraulics, Fuel Pumps, Air Pumps, Related Accessories...

PERFORMANCE POINTS TO Pesco FIRST

DIVISION BORG-WARNER, CLEVELAND, OHIO

AIR
iberator
gain!
aces,
ation
ision.
RST
OHIO



began flying. He was 15 years old. During the winter, for he spent the summers in Spokane, he "hung around" the old Curtiss airport in Garden City. He got in four hours on a *Jenny* before his mother learned of it and forcibly called a halt.

Flying had begun coursing through his veins and it could be stopped only temporarily. He resumed the following year, and in 1930, his father bought him an OX5 Eaglerock. Since then he has flown at least 50 different kinds of low-horsepower ships.

Bellinger himself doesn't know whether his first non-domestic love is flying or auto racing.

In 1935 and 1936, he abandoned flying for the sport of whizzing around dirt tracks. In and around Seattle and Spokane anybody who owned stock in fence companies regarded Bellinger as a friend, because he mowed down fences with such regularity that he was accused of aiming at them.

But as fast as he was going, his mother caught up with him. She knew he had racers, and believed he was using them for his own pleasure (and he was) but when newspaper reports reached her that he was the chief fence destroyer of the Northwest outlaw ovals, she had a little talk with him; he returned to flying.

For three years Carl studied mechanical engineering at Yale, but in his final year he switched to industrial administration and now has an I.A. degree. It was during his college days that he would drive to the Bethany airport outside of New Haven, climb into his ship, fly it to Roosevelt Field, and motor to his home in Queens for dinner.

After he graduated, his father established him in the airplane repair business, at Roosevelt Field. Here, with the aid of two workers, Carl sewed fabric, doped, made minor engine repairs, and in his own words, "damned near froze to death." Financially, the enterprise was a bust, so Carl pulled out of the staggering business.

Foreseeing the opportunities in the rapidly expanding military aircraft field, Bellinger came to Republic in November, 1939, as a time-study man and stock chaser. Later he was promoted to outside production, where he represented the company in its dealing with sub-contractors. Non-flying work, however, palled on him. He left Republic in May, 1942, to obtain a rating to become a civilian primary instructor. At Valhalla, N. Y., in a Piper *Cub*, he added 50 hours to the 1,450 he had in his log book.

After obtaining his rating, Carl returned to Republic Aviation to ask C. Hart Miller, vice president and director of military contracts, for a letter of recommendation to enable him to get a job.

The idea of becoming a production test pilot never even entered Bellinger's mind, when out of a clear sky, Miller suggested it.

"I was the most surprised guy in the world," Bellinger recalls. "But after I thought back on my flying time, my experience in advance aerobatics and my familiarity with the *Thunderbolt*, I told him I would be glad to take a shot at it. I was scared when I started my maiden flight in the '47, scared that I would disappoint Miller, Lowry Brabham, operations manager, and Joe Parker, our chief test pilot."

However, after the first two trips, he got the feel of the six-ton fighter and has been handling it like a veteran.

His accomplishment, it would seem at first glance, opens a new vista for aviators with *Cub* experience, but such is not the case. Carl's feat is one in a thousand.

END

Bottled Power

(*Continued from page 66*)

carbon dioxide. Rescue planes which may sight him are equipped with packages, tied to the plane by light cords. A door opens, out drops the package, and the cord snaps open a CO_2 bottle. The falling package balloons into a well equipped rubber boat before it hits the water.

The automatic CO_2 water wings, used before the war to prevent a land plane from sinking, were discontinued so that floating planes might not fall into enemy hands. But the British ferry command adopted a variation by which some models are equipped to float just long enough for the crew's escape.

Planes are beginning to be equipped with pendulums, held securly in place by springs. A crash is sufficient to swing the pendulum, and that swing opens the nozzles of various carbon dioxide fire extinguishers.

There are not only portable carbon dioxide bottles for fire extinguishing in the cockpit, but some newer, built-in systems. One of these is inside the extra gas tanks, which are often used to get a plane to the battle zone. While fighting, the fuel is taken from the self-sealing tanks which do not explode from a puncture by a tracer bullet.

But the fumes remaining in even an empty extra gas tank are an explosion and fire hazard. An automatic fizz bottle fills these tanks with carbon dioxide gas as the gasoline level lowers, eliminating the danger.

There are automatic, built-in fizz bottle systems also around the regular tanks. The self-sealing puncture can let out a little gasoline before closing, and that brief seepage can cause fire.

For smothering engine fires there are other built-in systems in each engine compartment. These are usually controlled by the pilot. By pulling a mechanical switch he can turn on the extinguisher fizz in any engine compartment.

The carbon dioxide merely reduces the oxygen in the air by about one-third—from about 20 per cent to 12 or 14. That is enough to smother fire. Even gasoline fumes won't burn with that percentage of oxygen. The fizz fumes will extinguish a fire instantly, but a man can live through them.

END

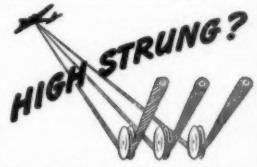
IN ENGINEERING
...AND BUILDING
...AND BOMBING!

EIGHTH IN A LONG LINE OF sister ships, Boeing Aircraft Company's present Flying Fortress is an outstanding American airplane *built for a specific wartime job.* As a high-level *precision* bomber she has no peer. As an exterminator of enemy fighter planes—well, few of the brash enemy pilots who have tangled with her thirteen 50-caliber guns have lived long enough to say "Banzai!" or even "Heil!" And the men who fly them know that these "Mary Anns" and "Susie Q's" are tough enough gals to struggle back home though shot full of holes and severely damaged!

America is proud of the men who designed this fighting ship, perfected her, engineered her into *precision* mass production. Proud too of the loyal flying crews who have acclaimed her as "a great ship!" And America is looking forward to knowing that greatness at first hand when Victory clears the skies for commerce and travel.

NAMES the U. S. must never forget

AERONCA
AIR CRUISERS
BEECH
BELL
★ BOEING
BOWLUS
BREWSTER
CESSNA
COLGATE
COMMONWEALTH
CONSOLIDATED
CULVER
CURTISS-WRIGHT
DOUGLAS
FAIRCHILD
FLEETWINGS
FLETCHER
FORD
G & A AIRCRAFT
GENERAL MOTORS
GOODYEAR
GRUMMAN
HOWARD
INTERSTATE
LOCKHEED
MARTIN
McDONNELL
NORTH AMERICAN
NORTHROP
PIPER
REPUBLIC
RYAN
STEARMAN
TAYLORCRAFT
TIMM
VEGA
VOUGHT-SIKORSKY
VULTEE
WACO



Feminine though our fighters and bombers may be to the men who fly them and name them, there's nothing high strung about their nerves. Control cord is only one part of an airplane's nervous system, but here at Roebling we make it with skill that insures rugged, strong, safe control wherever United Nations' ships shall fly. John A. Roebling's Sons Company, Trenton, New Jersey. Branches and Warehouses in Principal Cities.

JAR ROEBLING

*In these frequent messages, Roebling salutes each member of the aircraft industry in turn.

ROEBLING

means Control in the air

Aviation Offers You a Splendid Lifetime

Serve America in an Important Capacity Now

Be Prepared for a Fine Post-War Profession

Young men of America are now offered a great opportunity to quickly get into the scientific profession of METEOROLOGY. There is an urgent need for an increasing number of trained weather forecasters in aviation. Accurate weather knowledge is of the utmost importance to America's fighting air forces.

In SPARTAN School's Meteorology Department you get superior specialized training to equip you for a position as a skilled weather forecaster . . . training that assures your being of far greater value to your country when called to military service. U. S. Army Air Forces, the Civil Service and the Airlines are experiencing a critical shortage of weather forecasters.

(Above) Students and instructor gathering local weather information on the Spartan School observation tower.

A Bright Future is ahead for **both men and women** who are trained and ready to take advantage of the opportunities in the post-war aviation industry. Meteorology is a young science, and is probably the least crowded of any profession. The tremendous expansion ahead for the world wide airline routes will provide a wide choice of good-pay meteorology positions.

Meteorology training facilities at SPARTAN are the most modern obtainable. Four fluorescent-lighted laboratories are completely equipped. Students receive skilled personalized instruction . . . are taught from the viewpoint of direct application to the needs of the aviation industry.

This specialized division of SPARTAN has received high praise from Air Corps, Civil Service and Airline meteorology department heads for the thoroughness of instruction, methods of training, wealth of modern equipment, and quality of graduates produced. All these training advantages await you.

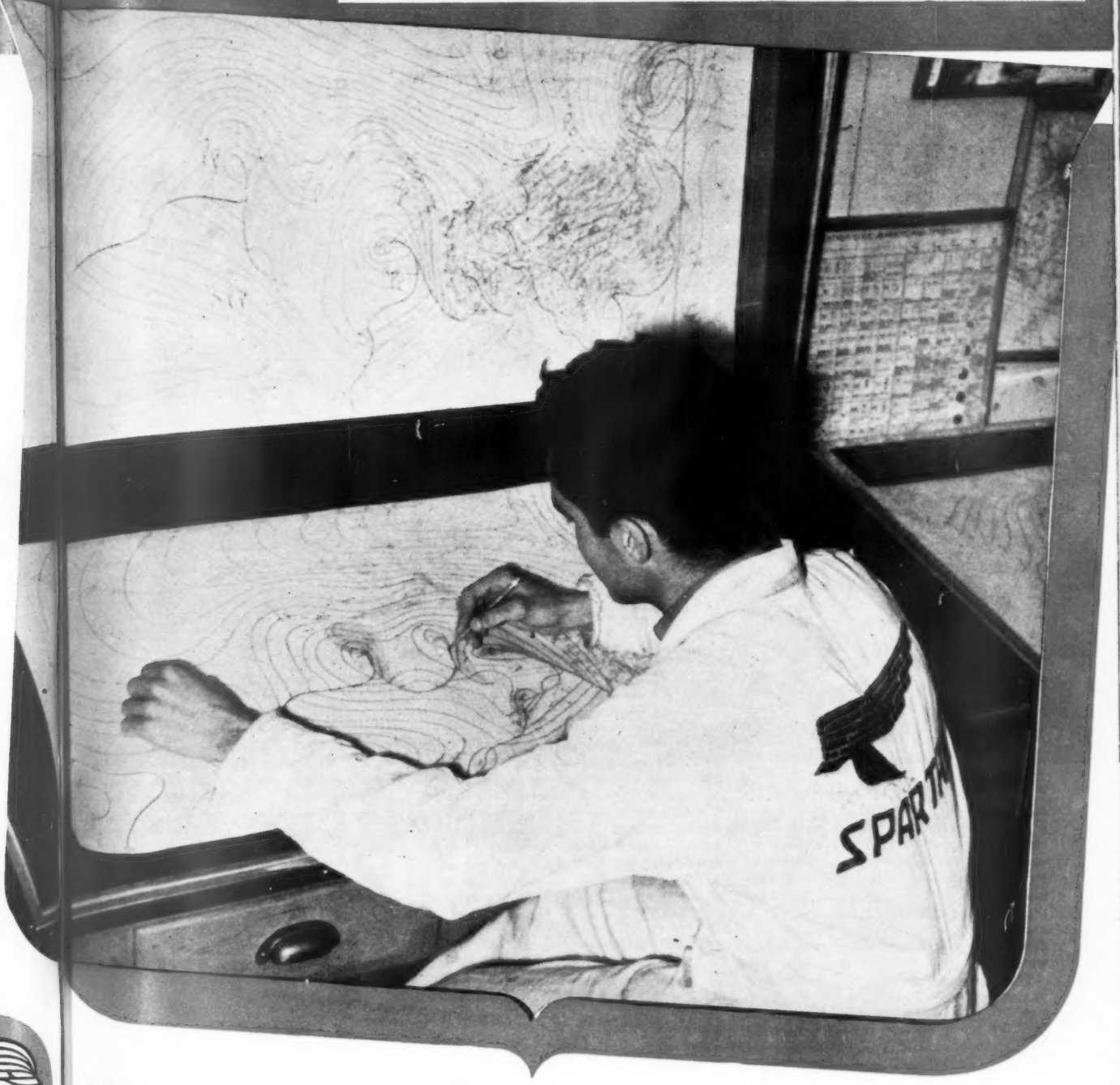
Announcing SPARTAN COLLEGE OF AERONAUTICAL ENGINEERING

Recognized and accredited by the Oklahoma State Regents for Higher Education. Affiliated with the Oklahoma State System of Higher Education. Intensified war-time scheduling enables students to earn 133 hours in 16 months. Graduates receive Associate in Arts Degree in Aeronautical Engineering.

SPARTAN

Many Other Career Courses in Aviation are available for you here at SPARTAN School. Whatever type of aviation career you choose—Commercial or Airline Pilot, Aircraft or Engine or Aircraft Assembly Mechanic, Aeronautical or Airline Maintenance Engineering, Weather Forecasting, Airline Communications, Instrument Technician—SPARTAN offers you advantages obtainable at no other school of its kind. Continue your education at this "University of Aviation" . . . to increase your value to America now . . . to be ready for a lifetime career after the war.

me Career in WEATHER FORECASTING



SCHOOL OF AERONAUTICS

DIVISION OF SPARTAN AIRCRAFT COMPANY

Next Semester in Weather Forecasting —July 4th. Next Semester in Other Courses Starts Aug. 2nd.

Mail the coupon for the new 64-page catalog which pictures and tells the complete story about the many

Spartan School of Aeronautics—Captain W. Balfour, Director Address Dept. F63, Tulsa, Oklahoma

Send me your new Catalog describing in detail the SPARTAN courses I have checked, also stating tuition and living expenses.

Name.....Age.....

Address.....

City.....State.....

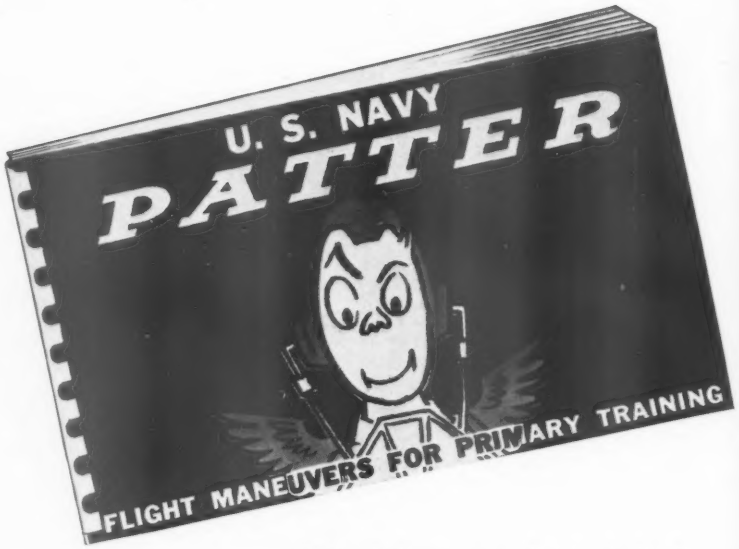
Previous Education.....

Check Courses You Prefer

- ☐ Commercial Pilot
- ☐ Airline Pilot
- ☐ Commercial Flight Instructor
- ☐ Aeronautical Engineering
- ☐ Airline Maintenance Engineering
- ☐ Aircraft or Engine Mechanic
- ☐ Aircraft Sheet Metal
- ☐ Aircraft Assembly Mechanic
- ☐ Airline Service (A & E) Mechanic
- ☐ Airline Communications
- ☐ Private Pilot Course
- ☐ Weather Forecasting
- ☐ Instrument Technician
- ☐ Women's Instrument Technician

'PATTER'

by
JOHN R. HOYT



Psychology scored a technical knockout when flight instructors had to listen to an actual recording of their own cockpit language.

HAVE you ever sat in a rear cockpit listening to instruction (mixed with metaphors) as it came scrambled from its original gargling, through the gosport? Have you ever wondered what on earth the instructor was talking about . . . what he meant by that anyhow . . . what he was sore about this time . . . and if he was so hot, why didn't he *show you* what he wanted?

If you have, you may know what is meant by teaching a student to fly. If you have not, you can imagine how hard it is for student and instructor alike to obtain the most efficient results from such instruction. Such a situation is more serious than it appears. In 1942 we were faced with a pilot shortage that was enormous and it immediately became necessary to train thousands of pilots with a very limited number of planes and instructors.

An ordinary observer might have said, "Fly the planes all day—fly the instructors longer hours." Yet that wouldn't have solved the problem—it would, as a matter of fact, have made it worse. Instructors can not fly all day, because a four-hour day in a plane is much harder than an eight- or ten-hour day on other jobs. In fact, a hundred-hour month is more than instructors can take month in and month out.

Instructors become so hard-pressed, irritable and nervous that an instruction hop becomes nothing more than another ride to them, with no other interest than to get back on the ground and get warm. Psychologists, who first noted this attitude on the part of instructors, bewailed the fact that the older pilots used such hard-boiled attitudes toward their students that a high percentage was being washed out.

The washout rate was the serious flaw in the program. If we had to pour 2,000 cadets into a flight training program in order to get 1,000 out, we were literally wasting 50 per cent of our time and effort. With planes scarce and pilots scarcer, valuable time was being squandered.

Such a condition could not be corrected overnight. It is difficult, if not impossible, to change attitudes in people. A scientific approach to the problem had to be worked out and then sold (psychologically speaking) to the instructors and students.

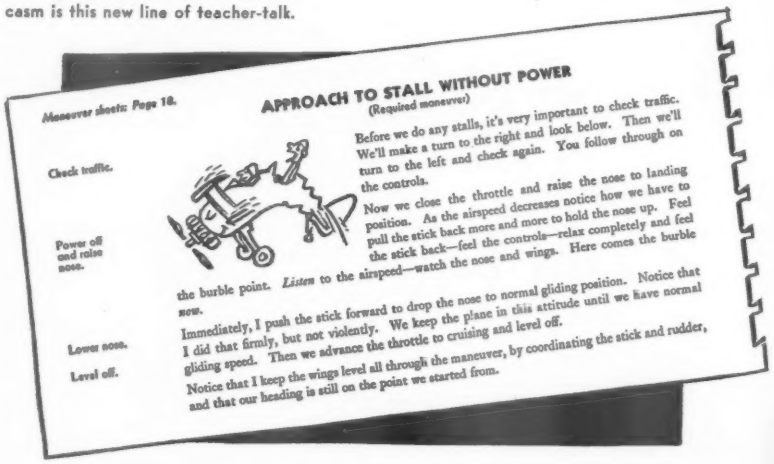
To begin with, a well-known psychologist and flyer at Purdue University, Dr. E. Lowell Kelly, determined to find out exactly what instructors were saying to their students, what vocabulary they used, and what methods were involved. It did little good to ask for demonstrations—what was needed were actual, word-for-word reproductions of the instruction as it went on in the air.

To achieve this purpose, a recording device was installed in several planes that permitted technicians to record everything that was said, either by the student or instructor. Later, the records were played back for the pilot and were also taken down by a stenographer. In almost every instance, the result was much to the instructors' dismay . . . most of them vowing that they "never said it," although "it" was down indisputably in the sound track on the record!

That instructors simply don't know how badly they instruct is axiomatic. The writer himself, guinea-pigging in an airplane equipped with a recorder as he instructed a prominent psychologist who was learning to fly, found that he was unintentionally sharp, biting, and sarcastic—all of which are not good traits in an instructor, regardless of how successful the students may be in passing their flight checks. The point is this: Those students might have been better

(*Continued on page* 142)

In sharp contrast to the old-time sarcasm is this new line of teacher-talk.


Maneuver sheets: Page 18.
APPROACH TO STALL WITHOUT POWER
(Required maneuver)
Check traffic.
Power off and raise nose.
Lower nose.
Level off.
Before we do any stalls, it's very important to check traffic. We'll make a turn to the right and look below. Then we'll turn to the left and check again. You follow through on the controls.
Now we close the throttle and raise the nose to landing position. As the airspeed decreases notice how we have to pull the stick back more and more to hold the nose up. Feel the stick back—feel the controls—relax completely and feel the burble point. Listen to the airspeed—watch the nose and wings. Here comes the burble now.
Immediately, I push the stick forward to drop the nose to normal gliding position. Notice that I did that firmly, but not violently. We keep the plane in this attitude until we have normal gliding speed. Then we advance the throttle to cruising and level off.
Notice that I keep the wings level all through the maneuver, by coordinating the stick and rudder, and that our heading is still on the point we started from.

"THE UNBELIEVABLE ADVENTURE"

— OVER DIAMOND HEAD ☆ ☆ ☆ In the dawn's early light of that fateful December 7th — civilian pilot Roy Vitousek met the adventure in real life, which we think of as belonging solely in the realm of such mythical supermen as Terry and the Pirates, Winslow of the Navy or Barney Baxter. ☆ ☆ ☆ Circling high o'er the beach at Waikiki he dived through the light early mist, to join what he assumed was a familiar squadron of Army friends on patrol — moments later a burst of machine-gun fire from the nearest ship emphasized the astonishing fact that he was tail man on the first wave of Jap planes attacking Pearl Harbor. ☆ ☆ ☆ The complete story of how this small sport plane...forerunner of today's Grasshopper...helped its owner become the Paul Revere of our undeclared war with Japan is but one more record in the long list of Aeronca — "First and Finest."

The true facts of "The Unbelievable Adventure" are inimitably described by Robert J. Casey in his glorious saga of our Navy's come back "Torpedo Junction", published by the Bobbs-Merrill Company of Indianapolis, Ind.

Robert J. Casey

FREE: "The Unbelievable Adventure" will be sent by addressing a post-card to Aeronca Aircraft Corporation, Middletown, Ohio.

© WALT DISNEY

AERONCA

AERONCA

FIRST *Grasshopper* FINEST

© 1943—Aeronca Aircraft Corporation

POWER TO WIN
Couriers of the air direct the striking power of our fighters in the field and often under the very noses of the enemy. Most of these nimble, undaunted liaison planes are dependably powered with Continental Red Seal Engines. Continental power — the Power to Win — is constantly serving our forces in many capacities on land, at sea, and in the air.
ARMY E NAVY
Awarded to the Detroit and the Muskegon Plants of Continental Motors Corporation for High Achievement.
Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN
CLARENCE COLE

NORTH AMERICAN SETS THE PACE

. . . in Tunisia

(One of a series reporting North American planes in action on the battlefronts of the world)

ESCAPING AXIS SUPPLY SHIPS UNDER ATTACK BY B-25 BOMBERS OFF THE TUNISIAN COAST

B-25 MITCHELL BOMBERS BREAK HITLER'S GRIP IN AFRICA

"IN relay attacks, hour after hour, B-25 Mitchells hit docks and shipping at Sousse, on the east coast of Tunisia . . . The important railroad junction at Hammamet was pounded hard by B-25's . . . Mitchell bombers raked the Tunisian railroad along which Axis troops and supplies have been arriving . . . An aerial cover of Mitchells and fighter planes protected the Americans advancing on Gafsa and tortured the fleeing enemy . . ."

Dozens of stories like these have come out of Tunisia. They place the North American B-25 Mitchell bomber high on the list of causes for breaking of the Axis grip in North Africa.

Now the enemy's power in Africa is broken. Soon the Mitchell and other great American planes will be over Southern Europe and another front will be added to those on which "North American Sets the Pace."

This pace-setting begins in our plants, where thousands of men and women work night and day to make North American bombers, fighters and trainers better, and to turn them out faster. Wherever our planes are fighting, trained North American employees go along to find out how they perform. Reports from these field experts have resulted in many improvements that are aiding the United Nations around the world.

Here at North American we're learning a lot of things about airplanes that no one ever knew before. Things that will help end the war sooner. Things that will help make the peace more lasting.

NORTH AMERICAN AVIATION, INC.

Inglewood, California
Kansas City Dallas

Member, Aircraft War Production Council, Inc.

B-25 MITCHELL P-51 MUSTANG AT-6 TEXAN

NORTH AMERICAN

Sets the Pace!

Behind OUR VICTORIES *is* SUPERIOR TRAINING...

Victories in the Air originate on our home front—on the Army training fields where our Pilots receive the thorough schooling that prepares them for combat.

The Bomber Pilot in training must have absolute confidence in his equipment, in order to attain the concentration on accuracy required in modern precision bombing. Complete engine reliability is of utmost importance in gaining that assurance.

Jacobs Engines power more twin-engine Training Planes than all other engines combined—because they give the Bomber student that freedom to concentrate.

These efficient, reliable engines will give the same feeling of assurance to Commercial Pilots and to the Business Man and the Sportsman flying their own planes, after Victory is achieved.

JACOBS AIRCRAFT *Engines*

POTTSTOWN • PENNSYLVANIA U•S•A•

THE LIBRARY

THE AIR OFFENSIVE AGAINST GERMANY, by Allan A. Michie. Henry Holt. 152 pages. $2.

Allan Michie's book gives one the impression that it might well have been written by cantankerous old C. G. Grey, the English aviation writer who firmly believes that, outside of the German air force, the only things worth a damn in aeronautics are in England. The book is extremely pro-British, having few good words to say for American aviation.

The general theme of the book is that Germany should be blown to bits from the air. Mr. Michie seems to have indulged in the old trick of listening to the plans of the military aviation leaders, then turning around and writing a book outlining those very plans, giving the impression that he is advocating something that hadn't been considered in the past. It's an old ruse and it usually works, for the simple reason that no military man will confirm or deny that such plans actually exist.

So it is no trick at all for Mr. Michie to advocate that the heart of Germany's war effort be blown to bits, city by city, knowing full well that it actually is going on and that, even as he writes, the air offensive is being stepped up tremendously, just as he "predicted"—and just as the RAF planned it many, many months before.

Mr. Michie summed it up nicely in the foreword of his new book when he said: ". . . It was written in 10 days after arriving in America from London. For its hurried preparation I make no apology. What I have to say has to be said quickly . . ."

From the standpoint of timeliness, Mr. Michie's book makes above-average reading. Yet, despite the fact that he brushes off inaccuracies with his introductory statement, we can't agree with his excuse entirely. So far as the basic facts are concerned, we feel justified in holding him responsible for every word. He sets himself up as an air-war expert, so we think we should discuss his book in view of his own assumption. Surely he doesn't expect us to believe that his general knowledge of the subject was crystallized in the 10 days he took to write his book.

In other words, Mr. Michie's book, for all its authoritative atmosphere subtly injected in off-hand references to his personal visits with Britain's military aviation leaders, has several serious basic errors. In view of the fact that so many laymen have gobbled up parts of the Michie book as gospel, Mr. Michie's shortcomings should be discussed.

For instance, he criticizes U. S. Army Air Forces officials for not producing at much greater speed such "new and more formidable" types as the Boeing B-29, Consolidated B-32 and Lockheed B-49. He makes the flat statement that the Curtiss *Helldiver* is "excellent."

We can't help but wonder where Mr. Michie gets his information. When his book was written, the B-29 and B-32 were pretty much a mystery to the manufacturers themselves; they had reached the test flight stage, but that's about all. We wonder how he knows that the *Helldiver* is excellent? When his book was written few if any had ever been delivered to aviation units of the Navy.

We can best sum up what we think of such "authoritative" statements by quoting a sentence from page 119 of Mr. Michie's own book: "This comparison of planes not yet in combat with planes actually being operated by the enemy is both dangerous and misleading."

Meanwhile, Mr. Michie thinks we should let him plead "haste" when he says things like this ". . . The Douglas TBD Devastator torpedo bomber [is] extremely good." He, of all people, should know that the *Devastator* has been obsolete and out of the Fleet for nearly a year; the type literally is extinct.—M.K.

THE FIRST CENTURY OF FLIGHT IN AMERICA, by Jeremiah Milbank, Jr. Princeton University Press, Princeton, N. J. 248 pages. $2.75.

The emergence of air power as a predominant element of military and Naval warfare and the ever increasing importance of air transport have inspired a new interest in the records of those pioneers in aeronautics who rightly deserve the credit for their daring efforts to prepare the world for the coming of an air age.

The work of General Mitchell and the Italian proponent for blitz strategy of air attack, Gen. Gulio Douhet, have been re-examined in the light of recent events. The first authoritative history of the work of the Wright brothers is now available to carry the record back to 1900.

Before that, the history of American aeronautics has been a vague and unexplored field. Jeremiah Milbank, Jr., while at Yale, started an investigation of the early experimenters of air voyaging in this country and his book "The First Century of Flight in America" is the result. England, France, Italy and Germany have voluminous histories of this period but the United States has neglected to place before the world our great achievements in the air which go back to Franklin, Jeffries and Blanchard in the 18th century. Before the Wrights, American genius indoctrinated the public with the feasibility of flight and prepared the way for the acceptance of power flight of our times. It is interesting to know that Citizen Genet was the designer of a dirigible airship in Albany in 1825 and that an airship belonging to the Aerial Navigation Company of New York actually flew from an airfield in lower New York to Astoria, Long Island, in 1863. The *Aeron* of Dr. Solomon Andrews was the first American airship that flew.

No conception of a flying machine was too fantastic in the early days. Even the circuses lured the gullible by a machine operated by a typical engineer of the era steered by a young woman attired *a la* "Black Crook" chorus girl. The steam engine and paddle wheel propeller and smokestack lent reality to the design.

At the time of the Philadelphia Centennial in 1876, Charles F. Ritchel built a dirigible propelled by foot power and gave interesting exhibitions.

Even romance crept into ballooning. At Providence, in 1888, James Allen, one of the most famous of the early balloonists, held a marriage ceremony high in the air.

As a background of newly discovered record of American aeronautical achievement, Milbank traces the development of aerostation from the flights of Blanchard at Philadelphia in 1793, through those of the most famous of American balloonists, Durant, Wise, Lowe, La Mountain, the Allens and King, names almost forgotten by the present generation in heavier-than-air development.

It is interesting to learn of the beginnings

(*Continued on page 175*)

. . . and engineering that created the 'Grasshopper'

ABILITY TO FLY LOW and slow — to maneuver quickly, land easily on rough "postage stamp" fields—to stand up under tough punishment—to afford observer and pilot maximum vision all around—these were some of the qualifications our Field Artillery wanted in its L-2 liaison-observation plane. And those qualifications and a few more for good measure are what they got in the sturdy Taylorcraft "Grasshopper", adapted by Taylorcraft engineers from an already popular Taylorcraft tandem trainer—another of the American planes *engineered for a specific wartime job.*

America can be happy that Taylorcraft engineers were ready with the skill to meet those qualifications — not only for the winning of this war, but for its promise in the period of peace, when kiddies all over this country of ours will call from the yard—come 5:15 or so — "Daddy's circling for a landing, Mummy! May we run down and meet him?"

Getting in and out of close places calls for a sensitive control system . . . control cord that combines silky flexibility, steely strength, and extra ingredients called Knowledge and Experience. In thirty years of working with the aircraft industry, we've learned how to put those ingredients into every foot of control cord that Roebling makes.

John A. Roebling's Sons Company, Trenton, New Jersey. Branches and Warehouses in Principal Cities.

NAMES the U. S. must never forget

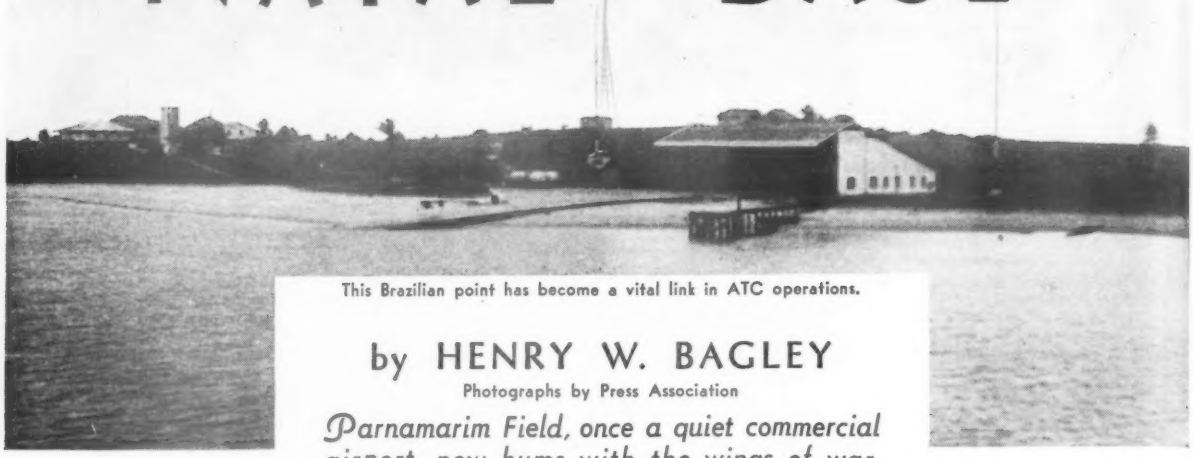
AERONCA
AIR CRUISERS
BEECH
BELL
BOEING
BOWLUS
BREWSTER
CESSNA
COLGATE
COMMONWEALTH
CONSOLIDATED
CULVER
CURTISS-WRIGHT
DOUGLAS
FAIRCHILD
FLEETWINGS
FLETCHER
FORD
G&A AIRCRAFT
GENERAL MOTORS
GOODYEAR
GRUMMAN
HOWARD
INTERSTATE
LOCKHEED
MARTIN
McDONNELL
NORTH AMERICAN
NORTHROP
PIPER
REPUBLIC
RYAN
STEARMAN
★TAYLORCRAFT
TIMM
VEGA
VOUGHT-SIKORSKY
VULTEE
WACO

**In these frequent messages, Roebling salutes each member of the aircraft industry in turn.*

ROEBLING

means Control in the air

NATAL BASE



This Brazilian point has become a vital link in ATC operations.

by HENRY W. BAGLEY

Photographs by Press Association

Parnamarim Field, once a quiet commercial airport, now hums with the wings of war.

THE big American two-engined bomber roars in, rolls to a stop halfway down the macadam runway at Natal, Brazil, and wheels aside. Another follows her, and another, and another.

The crews climb out and trudge across to one of the many long, one-story structures on the vast field—some to make their reports, some to get a shower and a change of clothing, some to tumble into bed for much-needed rest.

Gasoline trucks slide up alongside the gray-painted bombers, hoses are run in. Repair crews clamber over the ship.

Everything must be ready quickly, for these planes are going to push on—perhaps in a few hours, perhaps in a few days—to the fighting fronts of Africa and Asia.

When they again roar down that runway, most of them with the same crews, they will be off on the long jump through the tropical night to a mid-ocean rendezvous on a tiny British-owned island, some 1,000 miles east of Natal.

Before the next day is out, if all goes well, they will be somewhere in Africa, on the underside of Africa's great bulge.

Then within a few hours they may shoot off again—perhaps at different tangents. Some may strike up across British Nigeria to a Fighting French post on Lake Chad, in the heart of French Equatorial Africa; go on from there to the dry Anglo-Egyptian Sudan; then to a Red Sea post which Mussolini used in subduing Ethiopia, but now a British and American stronghold for African operations; thence along the edge of the Arabian Sea and finally into western India.

Usually the Allied forces in India take over here, but sometimes the ferry pilots fly on across India toward the frontier of Burma, for operations against the invading Japanese; or the men may take the ships into Chungking to join Maj. Gen. Claire L. Chennault's air force.

Perhaps, too, instead of going on eastward, the planes will turn northward to Cairo. In a few days they will be pounding the Germans and Italians in western Libya and Tunis. Or from their first landing-spot in Africa after the over-water jump, they may head westward, then northward, up the shore of the African hump, with stops in Liberia and British fields at Freetown and Bathurst to Morocco and Algeria.

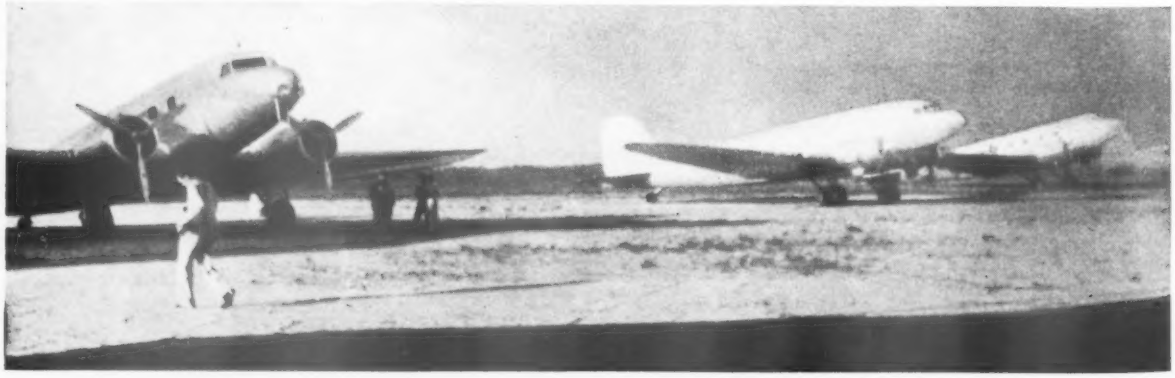
Natal is the middle point (and perhaps the key point) in Uncle Sam's long chain of air bases over which bombing and transport planes and supplies are fed to Allied forces extending half-way round the globe.

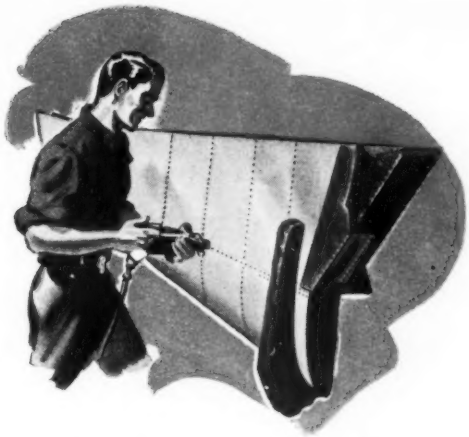
It is part of an aerial system running from the United States through Puerto Rico, Trinidad, British Guiana, Belem and Natal to African and Asian battle-fronts.

Lying on the bulge of Brazil which juts out toward the African hump, Natal has been much talked about as a place to be defended against Axis attack from across the water.

(*Continued on page* 167)

Douglas DC-3 transports on the line at Natal. Former U. S. airliners, they now fly to far corners of the world.





More Complete Salvage of Damaged Aircraft

SCRAP LOSS GREATLY REDUCED ★ LARGE DOLLAR SAVINGS MADE

★ RESTORATION of 99%* of damaged surfaces officially estimated to have no more than 50% salvage value is an Aero Services achievement that constitutes strong reinforcement to Army, Navy, Marine and Coast Guard maintenance depots.

As an auxiliary repair depot, Aero Services is of value not only for surplus work but especially for the more heavily damaged surfaces and parts, complete restoration of which requires special equipment and abilities not generally available.

With a personnel long experienced in aircraft maintenance and rebuilding, Aero Services facilities include, in a new, larger headquarters plant: welding, machine, and sheet metal shops; a die and jig shop; sandblasting, painting, woodworking, and fabric departments; Magnaflux inspection and engineering. We can and do make small and large replacement parts, and so avoid depleting plane manufacturers' reserve stocks.

Discarded production jigs of various plane manufacturers have been purchased by Aero Services and adapted to take the various surfaces, enabling us to make precision repairs.

It has been demonstrated that employment of Aero Services keeps more planes in the air with less drain on labor and material stockpiles, and that a very substantial dollar saving is made. This organization, Certified SAA Repair Station No. 221, also converts passenger aircraft for cargo carrying and other special purposes.

Army, Navy, Marine and Coast Guard aircraft maintenance depots can count on Aero Services for timely, dependable reinforcement. Let Aero Services help return more damaged planes to service.

**Several carloads of surfaces from the Sacramento Air Depot.*

Aero Services INC.

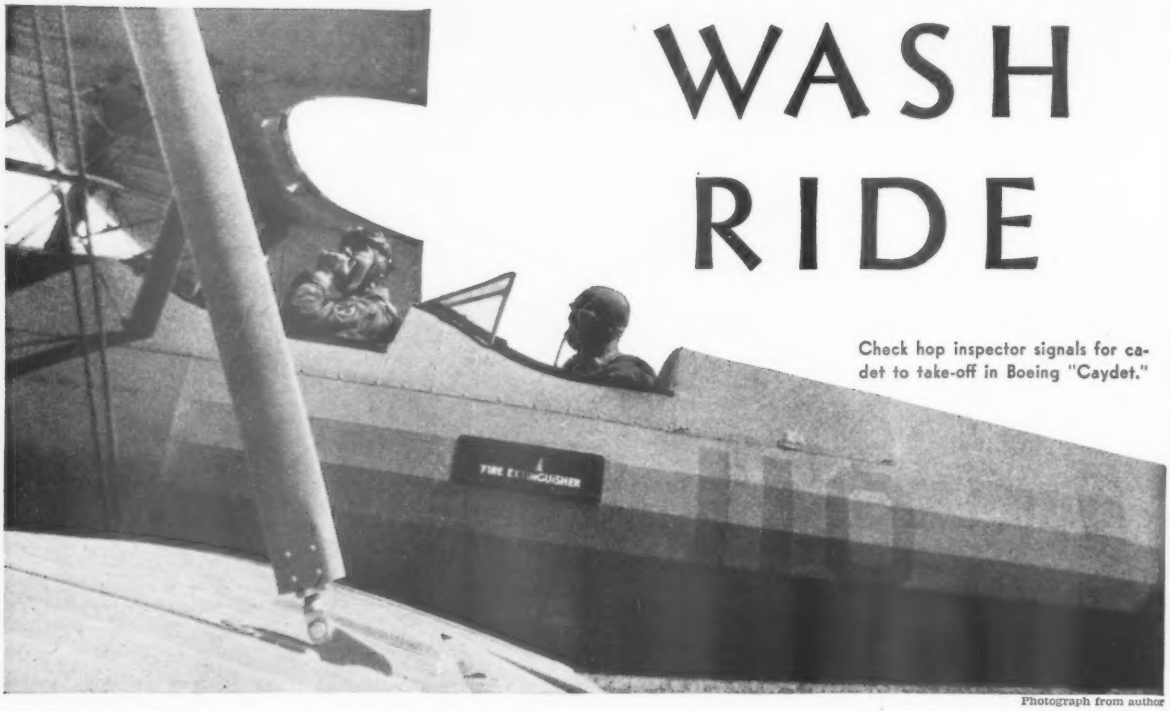
J. GORDON HUSSEY, PRESIDENT

RECONSTRUCTORS OF DAMAGED AIRCRAFT

CONTRACTORS TO ARMY AND NAVY AIR CORPS

METROPOLITAN AIRPORT • VAN NUYS • CALIFORNIA

WASH RIDE



Check hop inspector signals for cadet to take-off in Boeing "Caydet."

Photograph from author

by LIEUT. RICHARD RYAN

Once a medical student, Lieutenant Ryan was bitten by the flying bug about 18 months ago. Leaving school, he enlisted for Army air cadet training at Thunderbird Field. At present, he is stationed at Albuquerque as a bombardier cadet "taxi-driver." This is his second writing attempt.

Hell has no terror to rival that of a student pilot taking his first "wash ride" with a caustic Army examiner riding up in front.

A GROUP of new flying cadets were standing at attention while being addressed by their commanding officer. "Look at the man on your right." Heads turned automatically. "Now at the one on your left." Again neck muscles moved. "Nine weeks from now, one out of every three cadets will have been eliminated!"

This little speech was our introduction to the "wash-out" system employed by the Army Air Forces in the training of fledgling pilots. It was not to be the last we were to hear of it.

Everyone would not get the coveted silver wings of the Army flyer. This much we knew. Nothing more. The manner in which the good flyers were weeded from the incompetent was still a mystery.

We learned later that this is done by means of so-called check rides, in which experienced Army pilots test the flying ability of the beginners. These men are thoroughly trained to see the students' viewpoint. Their standards are severe, but their knowledge of all problems involved is complete. No square pegs in round holes. They would make certain of that.

In the training of Army flyers, there are three main causes of failures. It is on these that eliminations are based. If the cadet is unable to co-ordinate properly, if he is dangerous to himself and others while flying, or if he lacks proper judgment, he then obviously hasn't the qualities so necessary to be one of Uncle Sam's pilots.

Therefore, it is the task of check-riders to find those who have these qualities, and to eliminate all others. Harsh words and a stern manner are devices often used to determine whether or not the cadet will become easily rattled. Distressing factors are injected into the rides to test the students' judgment. From such conditions a rather complete analysis of a cadet may be made.

At Thunderbird Field, in Arizona's Salt River Valley, as in most Government primary training centers, the actual instruction is done by civilian flyers. They work with their pupils, ironing out rough spots, making the cadets sprout wings. These civilians are the ones who actually teach the cadets to fly. It is then that the Army pilots ride with each student and put him through his paces. It is the final examination in flying.

With this background, we started our training. A job far from easy. Landings, take-offs, spins, stalls, chandelles and lazy-eights until we wondered who was crazy—the airplanes or ourselves. It didn't take us too long to find out.

Worrying and working like all of the others, I tried not to notice the dismal shakes of my instructor's head, nor his side remarks after I had just made a particularly bad landing. He would carry on violently. "What did I do to deserve this?" or, "Why didn't I stick with my violin lessons?" I didn't blame him much. I felt the same way.

Tension increased rapidly as our training neared its end. Final check rides had already begun. Then one morning my heart skipped a beat or two. On the flight board was my name coupled with that of Lieutentant Adams. Check ride! Would it be a wash ride also? There was good reason to think so. Many classmates had already fallen by the wayside.

The unwritten rule is that a cadet always has to meet the pilot taxiing up from the ride with his previous student. This avoids all delays. My eyes X-rayed each individual ship approaching the line.

(*Continued on page* 171)

O. K.

You'll find no simple "O. K." stamped on a Boeing Flying Fortress.*

Nine thick volumes — hundreds of pages of individual O.K.'s—are accumulated during the manufacture of a Fortress. All are part of the inspection data on each plane. It's in the record.

Every one of two hundred fifty thousand-odd rivets has been individually O.K.'d. Every single part has been inspected. Every operating part and system has been functional-tested. Nothing is taken for granted—nothing is taken on faith—by these highly trained inspectors.

And when the huge Boeing bomber is rolled out onto the flight-apron, ready to take off for distant fighting fronts, the nine thick volumes are recorded on microfilm and carefully stored: a permanent history of a B-17, and a guarantee that the airplane is flawless in every detail.

This Boeing-developed inspection system is so organized as to be rigidly, painstakingly thorough without slowing up the ever-accelerating flow of production . . . and to compensate, where necessary, for shortages of skilled labor. It is another evidence of the manufacturing know-how which made possible, on desperately short notice, volume production of America's first four-engine bomber.

And when peace returns, and Boeing-designed-and-built Flying Fortresses, Stratoliners* and transoceanic Clippers have completed their last wartime mission, then Boeing's talent for manufacturing — plus equal talent for design, research and many varied fields of engineering—will serve you for *better living.*

Then the phrase "Built by Boeing" will mean greater convenience, greater safety, greater economy.

DESIGNERS OF THE FLYING FORTRESS • THE STRATOLINER • PAN AMERICAN CLIPPERS **BOEING**

*THE TERMS "FLYING FORTRESS" AND "STRATOLINER" ARE REGISTERED BOEING TRADE-MARKS

Airline Fuel Consumption

(*Continued from page 59*)

years. These, however, are impractical for use in transport planes which do not carry flight engineers and where there are only two members in the flight crew, as it requires too much time and calculation to adjust mixtures by their use.

Remote indicating flowmeters, reading directly in pounds per hour, have been used successfully for manual adjustment of mixtures on one airline also using the exhaust gas analyzer for the same purpose. Average fuel consumptions over a year's operation on four DC-3's equipped with flowmeters show that these planes have about the same average block to block fuel consumption as the planes equipped with exhaust gas analyzers. The flowmeter indicates immediately any change in the quantity of fuel being delivered to the engine and therefore the desired mixture setting is more quickly attained than by the exhaust gas analyzer. Also, a direct figure for consumption and weight reduction is indicated which the pilot can use without additional calculations.

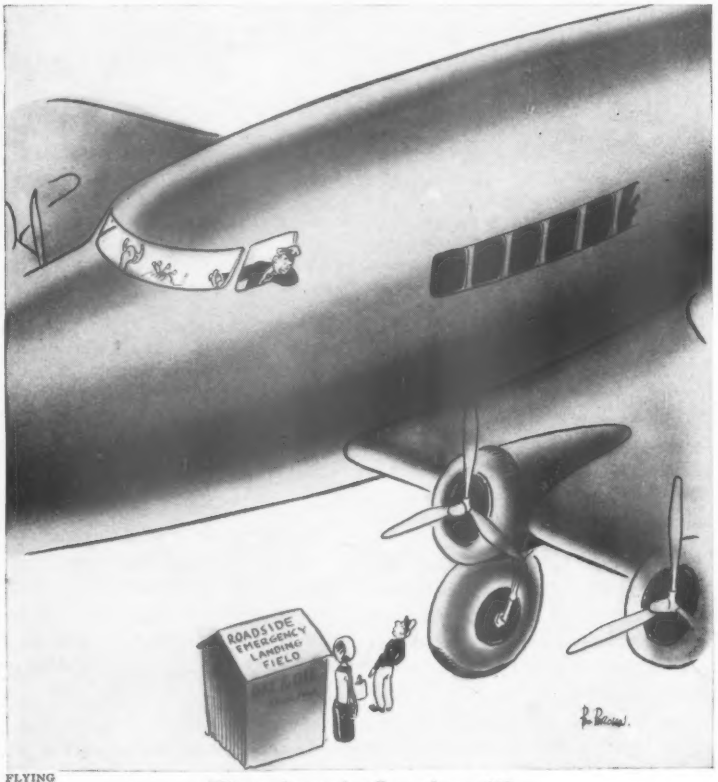
In adjusting mixtures by the flowmeter, the horsepower must first be established by adjusting to the desired r.p.m. and manifold pressure. As soon as the horsepower is adjusted, the desired mixture can be adjusted without delay. When using the exhaust gas analyzer for mixture adjustment, there is a delay required of from one to two minutes before the analyzer indication stabilizes. The flowmeter has the additional advantage in that it will indicate fuel flow regardless of the leanness of the mixture. One disadvantage of manually adjusting mixture by the flowmeter is that in hot weather the fuel lines are filled with a column of fuel mixed with a volume of air bubbles. This, in itself, creates a considerable error in fuel meters of the positive displacement type. Flowmeters with the vein type mechanisms are only slightly affected by air bubbles in the fuel. Large air bubbles create considerable fluctuation in the fuel flow, especially if the carburetor is equipped with an air separator, since the unloading of the air separator allows a sudden gush of fuel to fill up the space emptied of air. This pulsating makes the flowmeter indicator fluctuate accordingly and makes it difficult to attain an accurate adjustment of mixtures. Averaging the fluctuation of a flowmeter is rather difficult as the pulsations are erratic and far from regular and it is difficult to average the reading in relation to the time the needle remains at one or the other end of the fluctuation.

The automatic carburetor is an improvement in the technique of controlling mixtures in scheduled operation, especially in the twin-engined transport used on schedules where frequent stops are made and average time between stops is less than 1.5 hours. It has resulted in slightly lower over-all fuel consumptions. Although the principle of operation of the two automatic carburetors now being used are different, the results achieved are substantially the same. There is a set position of the controls for high power operations such as take-off and single engine operation; another position for climbing and cruising rich operation; and a third position for cruising lean operation. Almost no provision is made for intermediate mixtures between cruising rich and cruising lean. It is possible to obtain some intermediate adjustment but the control is very sensitive and not practical for normal operation.

With the automatic carburetor, the pilot has only two positions for climb and cruise operation to worry about and the probabilities are that the mixtures will be more closely adjusted according to the flight operation involved than with the manual method of mixture adjustment.

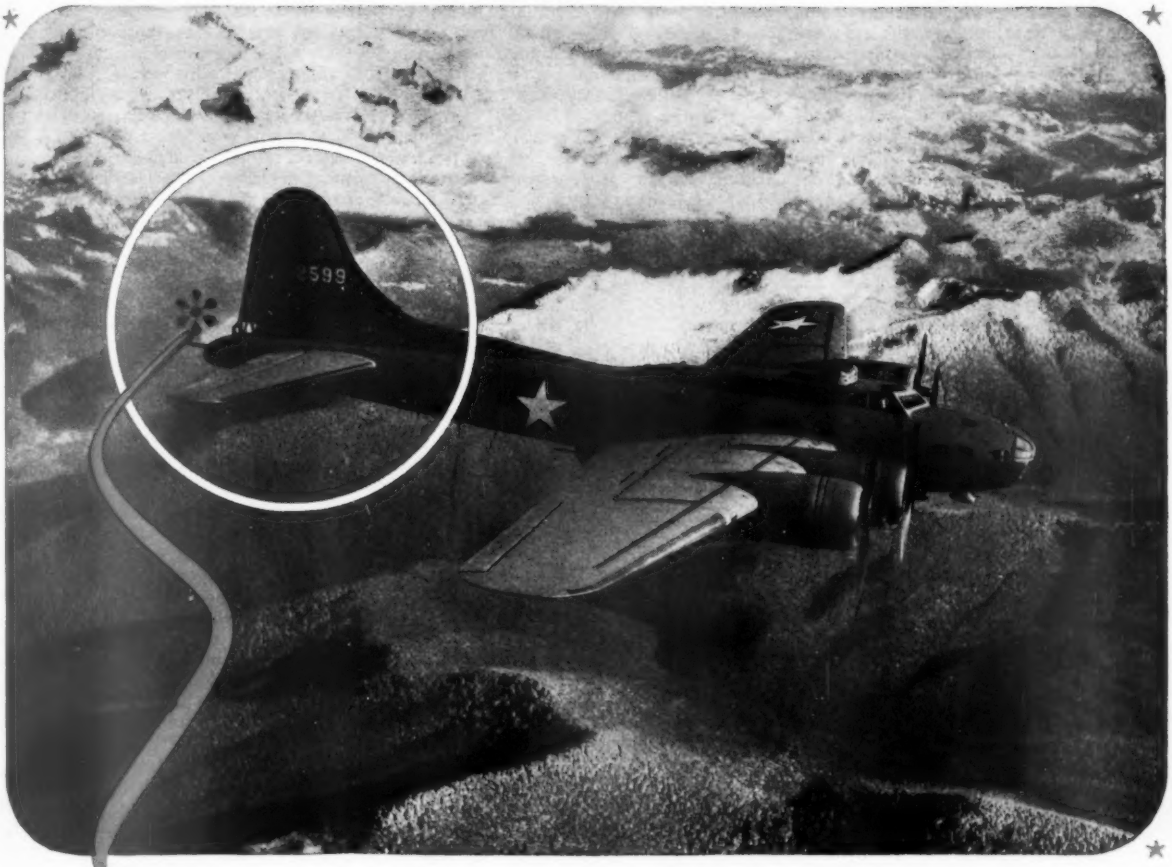
For airline operation, where the engine operating conditions are uniform, this system works satisfactorily. Under some conditions, it is necessary to operate richer than is necessary on account of the two position mixture control but as the percentage of time over which the rich mixture is required is a very small proportion of the total operating time, the loss in fuel economy is very small. Once the correct cruising lean mixture has been established which is suitable for all cruising level flight conditions, all carburetors can be adjusted accordingly and cruising consumptions can be held uniformly on all airplanes of the fleet. The greatest savings under this condition are probably brought about by taking the ideas of the individual pilot concerning the correct mixture at which to operate out of the picture and allowing him only one mixture for cruising lean operation. Many pilots are inclined to operate on the rich side of any recommended mixture setting under the manual mixture adjustment method. With an automatic carburetor, the mixture is preset for the pilot so that instead of controlling the mixture to an infinite degree, he uses cruising lean position unless some condition of the engine requires a richer mixture, at which time, he goes to cruising rich. The percentage of times at which this emergency arises is relatively small and the net result is a saving in fuel consumption during cruising and climbing operation over the manual adjustment method.

Although the automatic carburetor has proven its value on the type of operation the DC-3 is now used, it is not the most economical method of mixture adjustment for a long range operation such as is being conducted on transoceanic routes and will be conducted in long range transcontinental operation for four-engined transports after the war. Since it is necessary to establish the cruising lean mixture of an automatic carburetor at a specific consumption that will be rich



FLYING

"Eleven thousand gallons of gas, 300 gallons of oil and check the tires!"



How does a Bomber Pilot

COMMAND TONS OF PRESSURE WITH POUNDS OF EFFORT?

YOU'VE seen a heavy bomber change direction in the air—climb, bank or nose down. It looks easy, although the airstream is actually piling tons of pressure against the rudder and tail surfaces.

It even looks easy in the cabin, as you watch the pilot handle his controls. And it is easy, because a little trick called an "amplidyne"—which steps up electrical power input to the control motors about 10,000 times—is doing the work for him.

This mechanism, a development of one of the nation's largest electrical manufacturers, depends upon the special properties of an Allegheny Ludlum Electrical Steel to achieve its results. Into the steel, as it must be in the amplidyne itself, is built reliability, uniformity and stamina.

Although important, this is only one of the dozens of wartime electrical devices to which Allegheny Ludlum Electrical Alloys have lent desirable qualities of magnetism, high permeability, or high resistance. The list covers control, detection and communications equipment for all the services.

For engineers and production men desiring certified technical information on these special alloys, write for a copy of the *"Electrical Materials Blue Sheet"* or for the assistance of our Technical Staff.

ADDRESS DEPT. F-1

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

Steel-Makers to the Electrical Industry

A-8826 . . . W & D

enough to cover a wide range of cruising lean conditions, it is impossible to secure the leanest mixture possible for the changing powers and airspeeds most economical for long range cruising operation. There is still considerable controversy as to whether four-engined land planes require more than two men in the cockpit crew, especially if most of the operating accessories are made automatic in operation. Providing a suitable system of manual adjustment can reduce the average cruising consumptions by .03 lb./b.h.p./hour under that of automatic adjustment, a Flight Engineer on a four-engined transport using an average of 90 h.p. per engine for cruising can save his salary and payload weight in about two hours flying per trip.

Figure 1 [page 59] shows the cruising economy of a DC-3 in miles per gallon versus horsepower at 7,000 feet average cruising altitude and at 24,800 lbs. gross weight. The mixture is assumed to be .071 f/a or .465 lb./b.h.p./hour. Consumption lines for winds of 20, 40 and 60 m.p.h. are shown either side of the zero wind line. From the tabulation on page 94, it is noted that for an average 300-mile cruising flight, the fuel savings of 12 gallons can be effected by a reduction of 50 h.p. with an increase in cruising time of five minutes. Fuel saving of about 21 gallons is effected by the reduction of 100 cruising h.p. with an increase in time of 10 minutes.

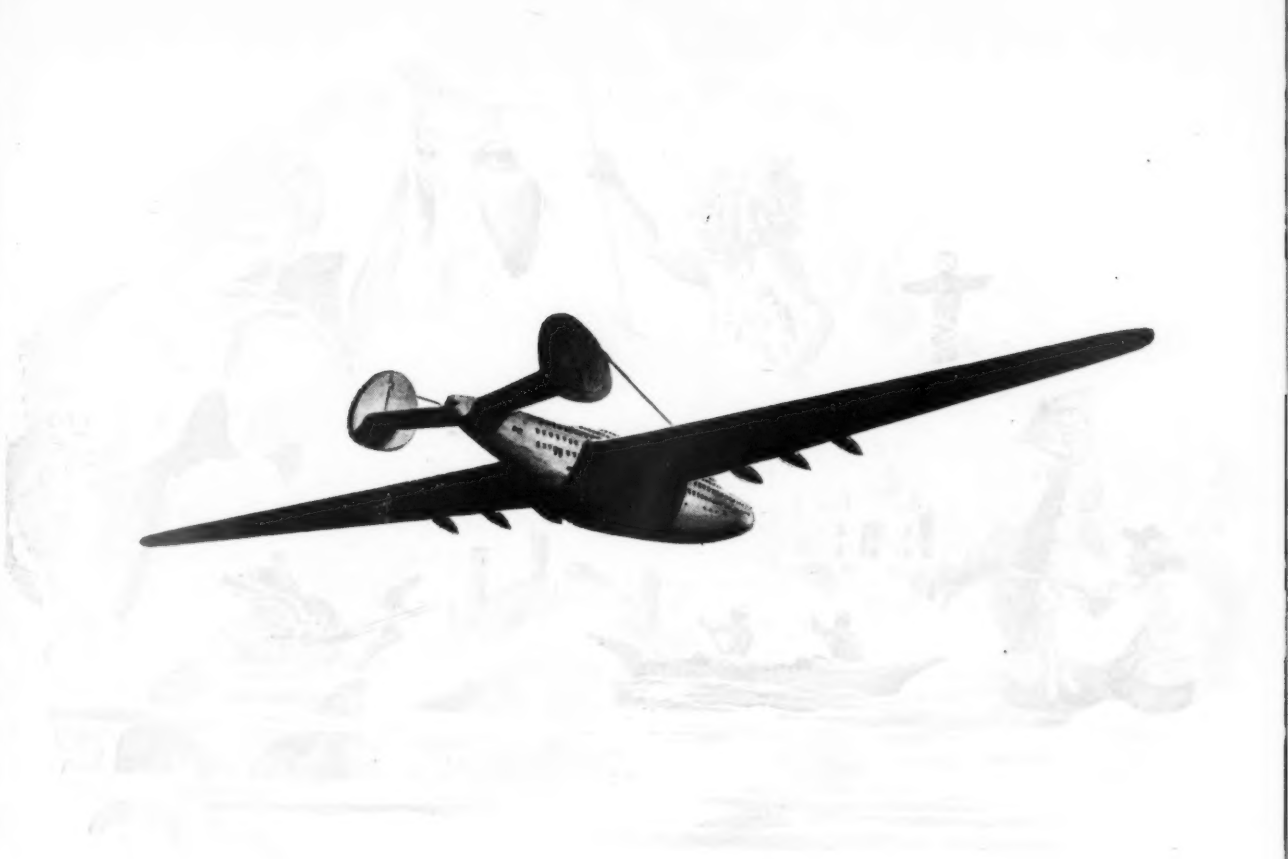
A transcontinental schedule of approximately 15 hours flying time would be increased about 36 to 40 minutes in time by a reduction of 50 cruising horsepower and 1 hr. and 20 min. by a reduction of 100 cruising horsepower from the 600 h.p. on which the average DC-3 transcontinental schedule is now operating. Considering that the total mileage flown by all airlines operating DC-3's in this country during 1941, was approximately 118,500,000 miles, of which about 85 per cent or 104,000,000 miles was cruising level and descent flying, the fuel consumption at 600 h.p. with an average of 10-mile head wind condition, would be roughly 56,250,000 gallons for the cruising operation alone (neglecting take-off and climb consumptions). If schedules were set up on a 500 h.p. basis, the analogous cruising consumption would be 51,900,000 gallons or a saving of 4,350,000 gallons per annum. If cruising powers were further reduced to 500 h.p. the analogous consumption would be 48,400,000 gallons with a consequent saving of 7,850,000 gallons per annum from the consumption at 600 cruising h.p. This represents approximately 10 per cent of the total consumption on the airlines for 1941. While this figure is not large when compared to the anticipated military and commercial consumptions for 1942-1943, it would be a substantial saving in the event of a critical situation in aviation gasoline.

Aviation fuel specifications thus far used have taken into consideration the lead content, the octane rating, evaporating characteristics, gravity and heat content of the fuel. About three years ago, fuel experts became aware that fuels which met the general specification differed greatly in the power they would produce under rich mixture conditions at high powers. Fuel samples from various parts of the country, all of which met the general fuel specification for airline operation, have been tested by both large engine manufacturers with the result that maximum rated take-off horsepower varied as much as 11 per cent at the point of detonation. Special fuels with high aromatic content have been blended which will produce even a greater spread in take-off power at any given rich mixture. The performance of an airplane can be considerably affected by such a power variation on take-off. The above figures would vary the take-off power of two 1,200 h.p. engines in a DC-3 as much as 260 h.p. A four-engined transport with 8,000 h.p. installed could be subject to as much as 880 h.p. variation when operated on different fuels, all of which would meet present fuel specifications. For the future fuel specifications, after the present emergency, the octane number must be pegged by an additional specification which will provide for a minimum rich mixture knock rating as well as a minimum lean mixture knock rating which is done in the present practice. Such a specification should guarantee fuels of uniform rich mixture power characteristics.

In the past, it has been impossible to make an accurate estimate of specific consumptions used by the various airlines for various types of operations because of the lack of uniformity in keeping records of fuel consumptions and because of the different basis upon which each airline computes its fuel consumption. The discrepancy is increased because of the lack of accurate power measurement. Tests on DC-3's conducted with torquemeters, flowmeters and exhaust gas analyzers indicate that there is a discrepancy averaging about four per cent between engine manufacturers' chart powers and actual torquemeter power delivered to the engine. As an example: a certain test conducted at 600 chart h.p., showed a consumption of 252 lbs. of fuel per hour, making the specific consumption .42 lb./b.h.p./hour. The torquemeters, however, indicated that 575 h.p. was being delivered to the propeller. On a torquemeter power basis, the specific consumption was .437 lb./b.h.p./hour. Such discrepancies existed throughout the tests, being a minimum when the engines were operated at best mixture settings and being a maximum when the mixtures varied farthest from best settings. On this particular engine, the torquemeter power was fairly uniform from best setting down to .074 f/a but as the mixture was reduced below .074 f/a, the power fell off rapidly until at .068 f/a, it was approximately 12 h.p. lower than at best setting.

When using engine chart powers on which to base engine power settings, there is no way by which the pilot can accurately determine the power being delivered to the propeller. Indicated airspeeds may be used as a rough approx-

"War is full of surprises, ain't it?"



Tomorrow

THE WORLD IS YOURS!

LONDON, overnight . . . Rio, over the week-end . . . Australia and back in a week. Tomorrow, by air, the world is yours!

Now, Martin aircraft are fighting on every front and are speeding the instruments of war to the four corners of the globe. After Victory, those lifelines will become airlines.

Already on Martin drawing boards lie plans for giant airliners of 125 tons, capable of carrying scores of passengers, tons of freight, to the farthest of horizons. Other Martin ships of 250 tons and more are in the planning stage.

These Martin planes of tomorrow will be the product of no one man, one group or one department. They are coming from the effort of thousands of Martin workers. The man or woman who shows why a rivet should be moved, makes as definite a contribution as the engineer who designs a new wing.

Only by complete cooperation from each aircraft worker, all along the line, are great aircraft built. And it is this over-all refusal to be satisfied, this universal desire to produce something better, which makes American aviation feared in war and ready for peace.

The Glenn L. Martin Company,
Baltimore, Maryland, U. S. A.

Member: AIRCRAFT WAR PRODUCTION COUNCIL, EAST COAST, INC.

Martin
AIRCRAFT

Builders of Dependable Aircraft Since 1909

—and engineering that pioneered in plastic-bonded-plywood construction!

FIRST plastic-bonded-plywood trainer to receive Civil Aeronautics Administration approval, Timm's sturdy PT-220-C with slight modifications became the *only* plastic-bonded-plywood trainer in use by our Navy—another outstanding example of an American plane that *excels for a specific wartime job*. Thanks to the glass-smooth surface finish and high strength-to-weight ratio resulting from Timm's use of plastic-bonded plywood, fledgeling carrier pilots are getting performance and maneuverability in their trainers that enable them to step right into bigger, faster planes with a minimum period of adjustment.

America can well be proud of Timm's accomplishments. Not only in the building of these planes that are training Navy pilots faster, but for the development of "Aeromold" plastic-bonded-plywood construction. For in pioneering in new uses for man's oldest material, Timm has joined the ranks of those able scientists, engineers and technicians who are helping to create the building blocks of tomorrow's world on the very battlefields of today.

LINES OF COMMUNICATION

As the student pilot's direct link with his plane's sensitive control surfaces, aircraft control cords function as first lines of communication. Their "feel" in all flight attitudes is an indispensable adjunct to flight instruments and "pants seats" alike. Here, at Roebling, we make them with all the care they need to bear their share of responsibility.

John A. Roebling's Sons Company, Trenton, New Jersey. Branches and Warehouses in Principal Cities.

NAMES the U. S. must never forget

AERONCA
AIR CRUISERS
BEECH
BELL
BOEING
BOWLUS
BREWSTER
CESSNA
COLGATE
COMMONWEALTH
CONSOLIDATED
CULVER
CURTISS-WRIGHT
DOUGLAS
FAIRCHILD
FLEETWINGS
FLETCHER
FORD
G & A AIRCRAFT
GENERAL MOTORS
GOODYEAR
GRUMMAN
HOWARD
INTERSTATE
LOCKHEED
MARTIN
McDONNELL
NORTH AMERICAN
NORTHROP
PIPER
REPUBLIC
RYAN
STEARMAN
TAYLORCRAFT
★ TIMM
VEGA
VOUGHT SIKORSKY
VULTEE
WACO

**In these frequent messages, Roebling salutes each member of the aircraft industry in turn.*

ROEBLING

means Control in the air

imation in relation to a chart showing speed power relations based on torquemeter tests. Because of rising and falling air currents, airplane load conditions, etc., this method may introduce even greater errors into the picture. The only adequate method thus far found is the use of torquemeters on the engines for use in power adjustment. At the present time torquemeters are being used only in very special cases for power settings. Engines designed up to within a year ago have made no provision for the inclusion of torquemeters in the engine nose case. Some manufacturers, however, are recognizing the necessity and the possibilities for better engine operation by the use of torquemeters and it is hoped that future transport planes will be equipped with engines incorporating torquemeters for power adjustment.

When torquemeters are used for airline operation, operators will be able to affect a closer check on their operating fuel consumptions.

It is evident that comparisons of fuel consumption in airline operation at the present time cannot be made too accurately. Before greater accuracy can be obtained, it is necessary that several standards be established:

1. Manufacturers' chart horsepowers based on r.p.m. and manifold pressure are not an accurate basis on which to establish engine power. Torquemeter power is the most accurate basis, at the present time, upon which to base specific consumptions and until the airlines operate on torquemeter power basis, accurate comparison between various engine operating phases cannot be made.

Hp	Miles/Gal.	True Air Speed Cruising	Time for 300 Miles	Time Increase min.	Fuel Cons. gals.	Fuel Saving gals.
600	1.96	183	1:38	—	153	—
550	2.13	175	1:43	5	141	12
500	2.28	167	1:48	10	132	21

Tabular summary of a DC-3's fuel consumption, based on varying horsepower.

2. Fuel specifications must include additional requirements for establishing minimum rich mixture knock ratings in order to insure uniform take-off powers on all fuels purchased throughout the country and to permit airlines to obtain maximum take-off power performance from their engines and with a minimum standard mixture setting for take-off and rated power operation.

3. Instrumentation must be improved for measuring carburetor mixtures, fuel flow in lines and fuel quantities in fuel tanks in order to increase the accuracy of fuel consumption data and to allow the airlines to take maximum advantage of established mixture settings and procedures in scheduled operation.

END

Fast Flyers

(Continued from page 72)

without a scratch. He gave the credit to Flight Sergeant Lee, who "has brought us home through everything they could throw at us. He's the guy who knows where we're at. He brought us home times when we didn't even deserve to get home. Several times when we were limping home after a raid 'Siggy' steered us clear of a lot of flak that would have made duck soup of us if we had gotten into it."

Four of the five carry good luck charms. Young Loach does not carry a talisman. But here's what the others wear for a safe return when they go on bombing raids. Higham carries a piece of flak retrieved from his parachute after one of the crew's bombing trips over Germany. It would have caused a "very embarrassing wound" had it not been for his chute. Morrison carries a cigarette case formerly owned by John Dutton, son of "Red" Dutton of the old Brooklyn *Americans* hockey team. Young Dutton was Morrison's roommate and is now missing.

Lee carries a kola bear and a small crest sewn on his uniform. Wireless Operator Sveinson carries a brightly striped hockey sock, which he considers lucky. There may be something in all these good luck charms for the crew has not had any casualties on its 23 trips over Germany. They have used three planes on these raids, one coming home with half its engines gone and three holes in the side big enough to hold the head of a horse, the second having the lavatory smashed right out of it, and the third which they brought safely back from their raid on Saarbrucken.

When they arrived at Rockcliffe Airport, Ottawa, at midnight, they were met by Prime Minister Mackenzie King, Air Minister C. G. Power (who had arrived from England by air only five hours earlier), Defense Minister J. L. Ralston, and practically all the top ranking RCAF officers in the capital. The trip had been planned for many months, to follow immediately after a big raid on Germany. But not till a few hours before the plane actually arrived did even the highest officers in Ottawa know that the bomber crew was on its way, that Canadians would see and hear their own boys back from a bombing raid made only the day before. It brought the war very close to home for Canada.

END

Whatever model you choose . . . get FRANKLIN power

You will be offered a wide choice of private planes in the post-war world, ranging perhaps from helicopters to folding-wing, roadable models to types as yet undreamed of. You'll pick the one that best suits your needs, of course. But be sure your plane is powered by a smooth, economical Franklin engine. That way you'll get more miles of trouble-free, carefree flight. For forty-three years, Franklin engineers have been building fine air-cooled engines, and incomparably finer Franklins will be ready for the plane you fly after the war.

AIRCOOLED MOTORS CORP. ★ SYRACUSE, NEW YORK

Franklin
FINE AIRCRAFT ENGINES

Currently, Aircooled Motors Corporation's entire facilities are devoted to production of warplane engines for the Army Air Forces and the Bureau of Aeronautics, U. S. N.

How to Beat the Japs in China

(*Continued from page 50*)

liant victory. "I swung the flights over the bombers," he said. "I kept 'S-ing' to see more and to watch for enemy fighters. The air around us roughened from ack-ack. I admired General Haynes as he led his bombers through it all with never a turn that might have crossed up the bombardiers. I knew that Col. "Butch" Morgan, and others like him, was aligning the crosshairs on his Norden bombsight.

"The black and white puff balls of ack-ack came closer. Then I saw the bombs growing smaller and smaller as they fell in salvo. I yelled that they were on the way—'Okay, Hirohito! We have millions of others. When these hit we'll be back with more!'

"On we went across Victoria Harbor and I saw others head for the dry docks and power plants of Hong Kong. Fires showed against the green background of the hills. As the last bombs fell I breathed relief. I raised my movie camera and took pictures of the burning wharves of Kowloon. Then, just as I dropped the camera back in the map case, I saw them . . .

"Knifing up at us were the enemy interceptors. I called over my radio, 'Zeros at 12 o'clock!' Tex Hill answered, 'Hell, I see them!' All flight leaders now called 'Attack!' and the thin falsetto jabber of the Japanese came back to our ears as they tried to jam our frequency. Now Tex Hill rolled over on his back, followed by Captain Hampshire, and barrelled down on the Japs. I pulled out of my roll and caught the first enemy fighter in my sights. I let him fly into my line of tracers, and at that instant Tex flashed by me in his No. 151. His tracers hit the Jap, too, and the Zero fell in flames toward the water near the western tip of Hong Kong.

"I rolled now to shake off any pursuit, and saw Hampshire firing into No. 2 in the flight, so I took No. 3, diving on him from above. I saw pieces of wing covering first, then parts of his canopy strip off. Suddenly he flamed back for 30 feet and as I passed over him he exploded and fell, turning slowly over and over.

"As I climbed back to fighting altitude I saw five flaming planes falling, and I hoped then that they were enemy ships. (They were.) I next looked around to see a long formation of six or eight twin-engined Japs climbing steeply for our bombers.

"I dived for their leader. Once more an enemy plane grew in my sights. As I pressed the trigger I could see the red tracers going into him. His plane seemed to vibrate as the force of those six heavy guns struck. He rolled over slowly, evidently hit. I followed him and caught up with him as if he were standing still. I watched my guns strike again from very close range and the ship bounce at each impact. Flames streaked from first the right engine, then the left, and the Jap hit the sea only 1,000 feet below, skipped across the blue water and continued burning even as he sank.

"Our bombers were safely gone now. Fighters couldn't attack them, but we continued to fire into several to give them something to think about. I know my tracers hit four more. We fought the rear guard action until we were the only planes over Victoria Harbor. The entire action had consumed about two minutes!

"Well, we sure gave those big-toothed monkey-men something to worry over that day, for we made two more missions before we were through, and after watching that night's work I'm satisfied that we really have something. Tokyo admitted heavy damage; they had lost 18 fighters in the battle over Hong Kong—we lost none. Best of all about that battle, though, I'll always remember the sight of the prison camps far below—little black dots that were American, British and Chinese prisoners in the corners, looking up at the first sight of Allied aircraft they had seen since the previous December. We could imagine them cheering hoarsely, though they knew full well that they'd be treated miserably for days to come.

"We've dive-bombed the ships in Hong Kong and Kowloon plenty since then, but on this first day I got my seventh and eighth aerial victories."

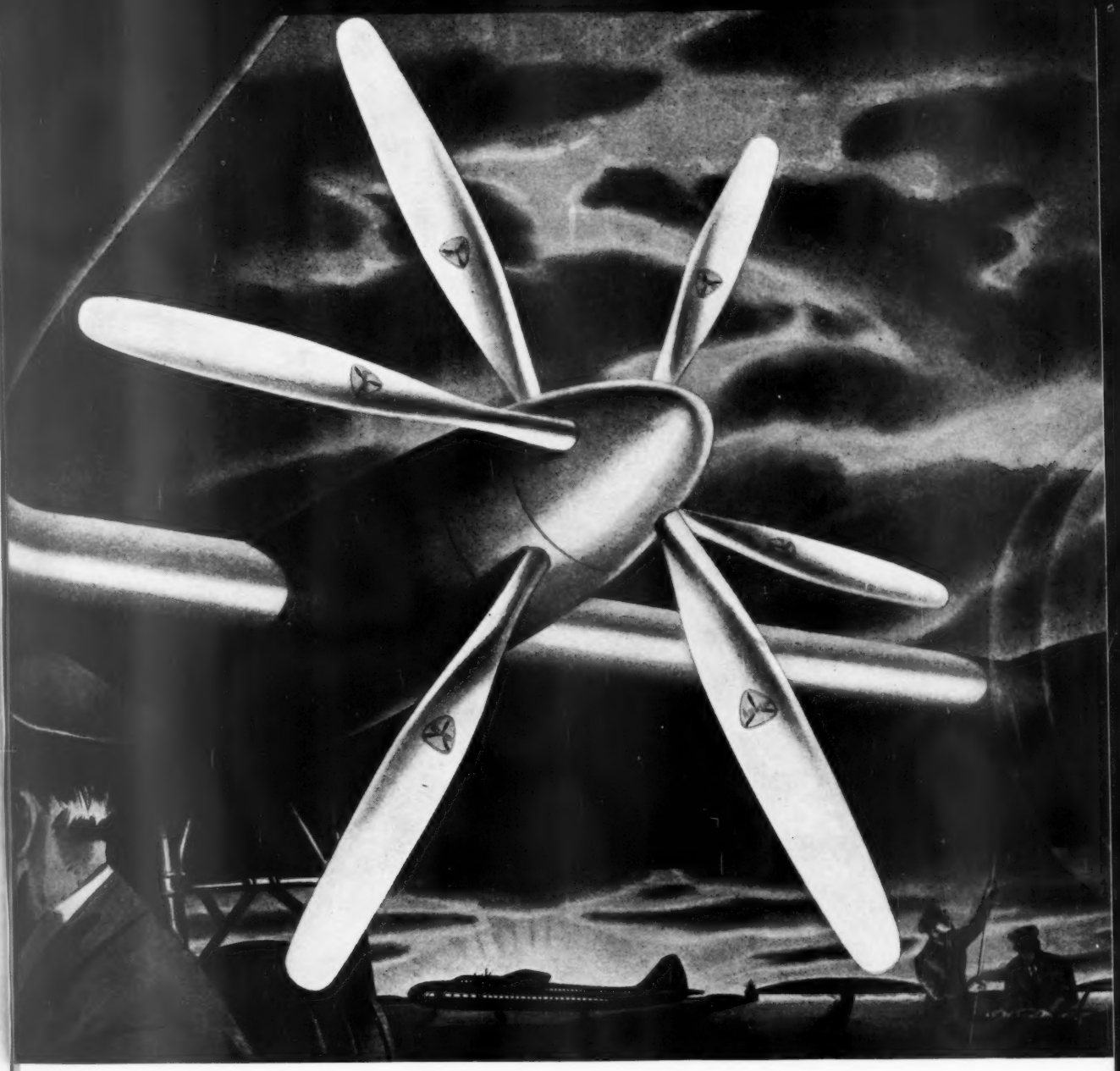
Scott had to wait patiently, with the patience he had learned from the Chinese themselves, for his No. 9. During October and November the 10th Air Force pulled eight heavy bombing raids escorted by fighters in six days! On the third Canton raid they shot down 24 to 29 Japs without a single loss to themselves. One day they set out with bombers and fighters to the edge of the Pacific. In the afternoon they sunk two big freighters and raised hell with coal production at Hongay. The Jap in retaliation struck that night after all the planes were back home, believing the U. S. pilots exhausted. The Nips circled the town in derision, lined up with the dummy runway and, diving low, began to machine gun and bomb the runway.

Yankee pilots were far from asleep. Guns chattered, and one U. S. plane went down in flames, but the pilot walked in two hours later. Soon the Japs were in trouble, falling on every side. At first,

(*Continued on page 101*)

FLYING

"I don't care what they do in the movies. We can't get it out of here!"



Dual Rotation—*the dawn of a new air age!*

TOMORROW'S SUPER-SHIPS are in the making now. Ready for them is the Aeroprop Dual Rotation Propeller. Developed through seven years of intensive engineering, the Dual Rotation Aeroprop is now ready for mass production—for our fighting ships and for the new air age of tomorrow.

Two sets of Aeroproducts' hollow steel blades, rotating in opposite directions, harness the vastly increased horsepowers of new aircraft engines. Thus, the Dual Rotation Aeroprop meets the demand for a propeller which absorbs greater horsepowers... improves propeller efficiency... reduces propeller sizes... and streamlines air-flow for greater speed, stability and safety.

In the swift rise of America's air supremacy, more powerful engines and improved propellers are an all-important team. This Dual Rotation propeller furnishes evidence that this progress will continue—that Aeroprops for tomorrow's planes will be ready.

AEROPRODUCTS *DIVISION*
GENERAL MOTORS
CORPORATION

GM ARMS FOR VICTORY

BUY WAR BONDS — KEEP AMERICA FREE!

Reprinted by request

Many requests have been received for copies of this dramatic Flying Fortress picture. Reprints in full color, 24 x 22 inches, free from advertising, are now available on a special heavy stock suitable for framing. Address Studebaker, South Bend, Indiana, enclosing 10¢ to cover mailing cost.

When the above Flying Fortress picture was first published in Studebaker advertisements last Fall, America's air might was just beginning to be felt in the Pacific and European war theaters. Today the Flying Fortress is spearheading one successful offensive operation after another. And every Studebaker man, who is privileged to help build Wright Cyclone engines for this invincible dreadnaught of the skies, follows the news of Flying Fortress victories with justifiable personal gratification in a job well done. Besides producing large quantities of Wright Cyclone engines for this devastating Boeing bomber, Studebaker is also turning out much other war matériel, including tens of thousands of big, multiple-drive military trucks. Studebaker is honored by its assignments in the arming of our Nation and its Allies.

BUY U. S. WAR BONDS

Studebaker BUILDS WRIGHT CYCLONE ENGINES FOR THE BOEING **Flying Fortress**

PLANES Plus Trained Men TO FLY THEM

By the end of the year a hundred thousand or more planes will have streamed from the Nation's production lines. This huge rate of output raises a serious problem of training the men to fly them.

Anderson Air Activities are shouldering their share of the great job of fitting more men for flying service. Anderson instructors, in close co-operation with the U. S. Army Air Corps, are training bomber and fighter pilots. To this job, they apply the unique combination of qualifications that mark an instructor as an "Anderson" man. They possess not only the experience and skill requisite to teaching flight fundamentals but also the talent of imparting that knowledge in a way that gives American fliers the edge in ability, resourcefulness and adaptability.

Merritt Anderson

ANDERSON Air Activities

Address Correspondence to ANDERSON AIR ACTIVITIES, Chester Field, McBride, Mo. Home Base: General Mitchell Field, Cudahy, Wisc.
Branches at Fond du Lac and Antigo, Wisc.

CONTRACTORS TO THE U. S. ARMY AIR FORCES

The Dramatic Story of

U. S. AVIATION COMMUNICATIONS

At War!

RADIO NEWS is proud to announce that the Special June Issue, a magnificent volume of over 300 pages, will present a complete report of U. S. Aviation Communications . . . Told for the first time by officers of the Air Forces and Signal Corps, officials and communications experts of the CAA and the CAP . . . Illustrating the important role of modern equipment and methods in global war and the phenomenal strides made in the development of radio and communications equipment. The print order of the Special U. S. Aviation Communications Issue of RADIO NEWS will be strictly limited . . . Reserve your copies now at your favorite newsdealer. 50¢ per volume.

16 PAGES COLOR • 16 PAGES GRAVURE

Featured in this Special Issue will be two 16-page inserts . . . in beautiful natural color and striking blue-black gravure of true salon quality . . . dynamic photographs, each a story in itself.

RADIO NEWS *SPECIAL JUNE ISSUE*
AT ALL NEWSSTANDS MAY 25th

(*Continued from page* 96)

the Blank Pursuit Group claimed only about three-fourths of them, but then all but one were found wrecked. Two days later that one was discovered by the Chinese 75 miles from Canton!

The following morning on a brilliantly clear day, the Blank Pursuit took off for the Jap base on Sanchau Island, hit it with heavy bombs and knocked out at least three of the four hangars, strafed ships taking off and returned home without loss.

That same afternoon they dived-bombed the warehouses and plane factories of Canton. The Japs wouldn't come up and fight, and this angered the Americans. So the next morning Scotty's outfit headed for Canton again and bombed Tien Ho airdrome. At least 65 per cent of the building area and many planes were destroyed. Not a single Jap rose to intercept, but the ack-ack was heavy.

That night the lads went wild. They struck to the northeast with dive-bombers and night strafers. Some of them dove so low that they could see the Hankow hangar doors were closed. Intense ack-ack hit all of them, but the sturdy Curtiss *Kittyhawks* took it. Captain Hampshire shot out three searchlights by diving down the beams; Johnny Allison strafed a big ocean-going freighter of about 8,000 tons. Others dived their fighters to bomb the docks and warehouses with heavy incendiaries. They left the scene after 22 minutes with many holes in their ships but the Japs had suffered far more, losing face and other parts.

The lads slept from 2 a.m. until 3:30, then went out and alerted the ships. Our bombers came in at dawn and they all took off for an objective just below Hankow. Bombers scored dead hits again and every bomb landed within the city walls, one hotel containing 125 Jap officers being destroyed. Again no interception, which was making the pilots mad.

They refueled, had a bite to eat and took off once more. This time Yoyang caught it. Bombs registered on warehouses and railroads and again the fighters went down to strafe. Again no interception.

Thanksgiving provided a breather. The following day the boys rose early and took off into the dawn for Canton. Turning, they came in over the target—three big freighters and the docks of the Whangpo.

"I could see the bombers split into four flights," said Scotty, "and I closed up our heavy force of fighters. There were no Jap fighters in the sky. Then suddenly I heard somebody say, 'There's one of the ——— coming up—you take him, Hamp.'

"Two ships dived and the Jap exploded. Boy, we had altitude on them this time and that's where we shine. Somebody knocked off another climbing up for the bombers. I saw one climbing steeply for the lead flight and I went to work. There were others coming up from far below. I could also see the smoke rings from their cannon.

"The first square-tipped Zero grew in my sights and, as he closed, I burned him

(*Continued on page* 138)

"Pilot's plane"

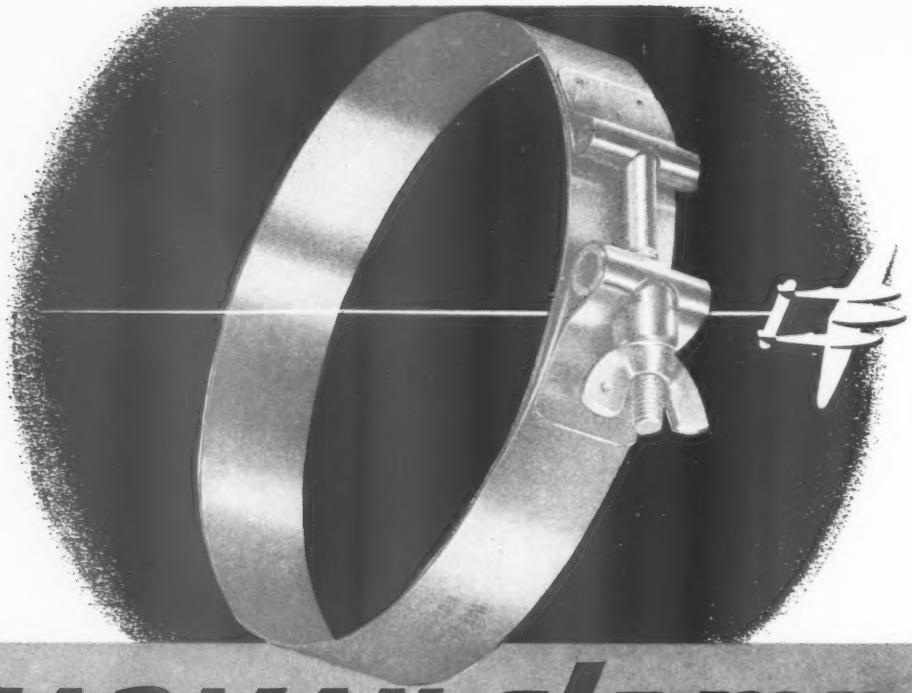
When she's sweet as a baby to handle —light on the controls and swift as thought responding to the throttle — that's a pilot's airplane.

Sure, she's built that way, put together like a hundred dollar watch. And we've had something to do with making her a well-mannered lady. Incredibly high-octane gasoline, for instance, that makes her big engine possible — gives it alert power, lightning speed. Performance like hers demands something special in lubricants, refined to be free-flowing in stratosphere cold—yet tough enough to stand high temperatures without wilting.

Each new step forward in aircraft and engine design tightens the specifications for fuels and lubricants. Right now, in Standard of California laboratories we're perfecting products that will help aircraft designers blueprint the bigger, faster planes of tomorrow. When they come off the line, to free a world or build a new one, waiting for them will be Standard's custom-tailored fuels and lubricants to help make every one of them —a pilot's plane.

Quality-Service STANDARD STANDARD

STANDARD OF CALIFORNIA



MARMAN clamps *Won't let go!*

They're Engineered to do today's War Job Better—Faster!

Marman Clamps are doing a better job...faster. Patented design permits the clamp to open, thus it may be installed after hose or ducts have been set in place. No special skill or tool is necessary; a quick turn of the wing nut—and the clamp is in place to stay. Circumferential tension is uniform around any convex surface...no bulges, bends or distortions.

Marman Clamps may be used over and over without loss of efficiency...AND Marman Clamps weigh substantially less than other clamps of the same strength.

Marman Clamps NOW Used By ***Consolidated, Vultee, Douglas, Ford, Rohr, Northrop, Solar, Wright, Briggs, Budd, Chrysler, Boeing and others.***

They are engineered to the job. Standard sizes ¼" to 38" in diameter. Prompt deliveries assured.

Only Marman Clamps Give You 17 Exclusive Features!

CIRCUMFERENTIAL LOADING

is uniform around any convex surface. No bulges. No distortion.

QUICKLY INSTALLED QUICKLY REMOVED

Marman Clamps may be opened to fit around hose. Reverse torque unnecessary for clamp removal.

A SIZE AND SHAPE FOR EVERY JOB

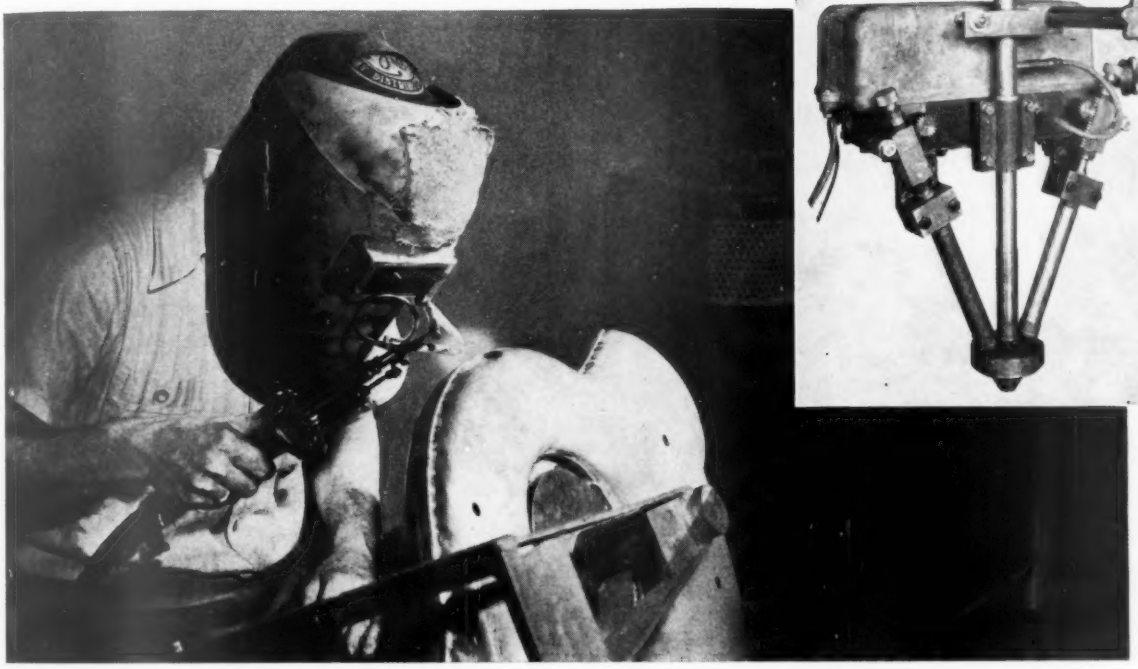
Round, Oval, Square, Oblong and irregular shaped ducts are *all* easily handled with Marman Clamps.

MARMAN PRODUCTS CO.

940 W. Redondo Blvd., Inglewood, California

Industrial Aviation SECTION

Atomic-Hydrogen Arc Welding Aids Production



The worker is using an atomic-hydrogen arc welding torch to weld a section of a turbosupercharger. Insert shows a close-up of the General Electric arc welding head with associated control equipment. Unit saves man-hours.

By R. A. WYER

Welding Engineer, General Electric

SPEED in fusion-welded fabrication depends on many things besides the rate of movement of the arc or flame along the joint. Atomic hydrogen arc welding often speeds production because it permits welding without flux and because it cuts the time of subsequent grinding or finishing. On some jobs the process will reduce rejects enough so that this is the most important reason for its use.

Compared with metal arc welding, the atomic hydrogen process is inherently slow, particularly where the joint requires the addition of considerable filler metal. Yet the process constantly widens its field of application under the pressure of war production—proof that other factors besides arc-travel-speed influence production speed.

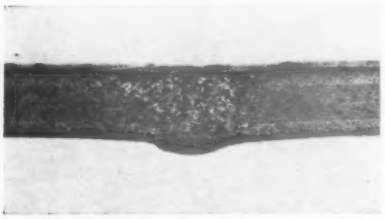
Typical is its use on stainless and other high-chromium alloys. No flux is needed for the welding process, thus eliminating the frequently troublesome and time-consuming operation of cleaning the pieces after welding. This factor has been found extremely important, for example, in the fabrication of engine exhaust stacks and supercharger nozzle boxes.

The low gas pressure in the flame produced in the atomic hydrogen process is frequently helpful in simplifying and speeding up production. Particularly in thin sections, there is a marked difference in this respect in welding with the atomic hydrogen arc as compared with ordinary gas or metallic arc welding. The low velocity of the hydrogen issuing from the electrode holder produces little if any tendency to blow holes in the joint. For this reason, joint design is often made easier and backing of the weld is simplified where this process can be applied.

The reduction in overall time chargeable to welding may be augmented by the high surface tension of molten metal in the hydrogen envelope. The hydrogen atmosphere around the molten pool pre-

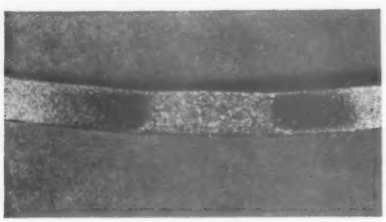
vents oxidation and frequently reduces oxides already present. This increases the surface tension, thus permitting the maintenance of a molten pool large enough to assure good fusion without danger of the pool dropping through. Because of this combination of high surface tension and low pressure from the flame, butt joints can be made without support on the underside of material as thick as 5/32 or even 3/16-in. thick.

Finishing the surface of the completed weld is usually easier and faster, or its need eliminated, with the atomic hydrogen arc welding process. This is particularly important on the inside of closed vessels or tubing, where the smooth and uniform bead on the back side of the joint may require little if any attention. The surface of the atomic hydrogen arc weld is smooth, especially in applications where automatic welding heads or mechanical traverse of the joint and a steady rest for the operator's hand can be employed.



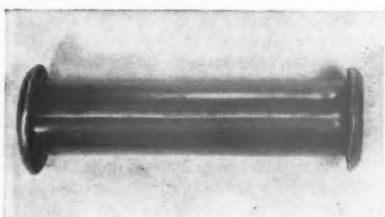
Section of unsupported butt joint in 1/8-inch plate welded by atomic-hydrogen arc.

Underside of manual atomic-hydrogen arc weld on butt joint in 0.0375 inch steel.



Section of joint shown in photo above. It illustrates the contour of weld.

Atomic-hydrogen arc welded 18-8 stainless steel tubing with ends spread to check strength and ductility of weld.



The unusually high and uniform quality characteristic of atomic hydrogen arc welds can result in an increase in production efficiency even where the welding speed per minute of arc time is slower than with metal arc welding. In some cases, the atomic hydrogen process can be employed in production welding on work that would involve impractically elaborate and close procedure control to prevent excessive rejects with other fusion-welding processes.

The high quality of the atomic-hydrogen weld deposit results from the extremely accurate control of the heat input rate to the joint to be welded, the protective atmosphere of hydrogen surrounding the molten metal, and the latitude afforded in the selection of the composition and rate of addition of filler metal, if filler metal is used. The absence, in most cases, of flux or slag also contributes to the unusually sound, ductile, and clean weld metal.

Gas accumulators for aircraft can be fabricated from light-gage materials, yet these parts can be depended on for the high tensile strength and soundness required to withstand high gas pressures. At least four fabricators are using the atomic hydrogen process for this application, welding approximately 1/32-in. stock at speeds of from 15 to 30 inches per minute.

Its application in the fabrication of landing gear and hollow blade propellers exemplify its use where speed is secondary to quality—where only *the soundest* weld deposit is good enough.

Because of its inherently slower speed of depositing metal as compared with metallic arc welding, the atomic hydrogen process is relatively limited in its field of application. Where large amounts of filler metal are required to complete a joint, atomic hydrogen is used only in those cases where deposited metal of the proper analysis cannot be obtained from arc welding electrodes, or where the stress or fatigue resistance requirements warrant its use to obtain smooth contour and extra sound and dense weld metal.

In the fabrication of thin stock, particularly where the joint can be prepared in such a way that it will require no addition of filler metal, the atomic hydrogen arc welding process finds a broad field. Automatic welding heads are widely used in the production of tubing made of alloy steels, including the 18-8 steel, chromium, chromium-aluminum, and SAE-4130 steel, as well as Inconel.

In designing joints for atomic hydrogen arc welding, the use of large amounts of filler material should be avoided where possible. As in gas welding, filler metal can frequently be provided by using edge wells, or by turning up the edges of butted pieces slightly. Lap and butt joints with metallic backing should be avoided, particularly for automatic welding. Fillets may be made with the atomic hydrogen arc in manual welding, although this requires probably more skill on the part of the operator than butt joints or edge welds.

Briefly stated, atomic hydrogen arc welding involves the transfer of heat from an electric arc between two tungsten electrodes to the work. While this transfer will occur to a slight degree by natural radiation and conduction of heat, the rate of heat transfer is enormously increased by the presence of hydrogen in the vicinity. The intense heat of the arc dissociates, or breaks down, the molecules of hydrogen gas into atoms. (Hence the name "atomic hydrogen arc welding.")

The dissociation of molecules into atoms absorbs large amounts of heat from the arc. This heat is liberated at the surface of the work by the recombination of atoms into molecules. The cycle of dissociation and recombination thus acts like an effective heat pump, taking heat from the arc and depositing it on the surface of the work. This results in the rapid and efficient heat transfer characteristic of the process.

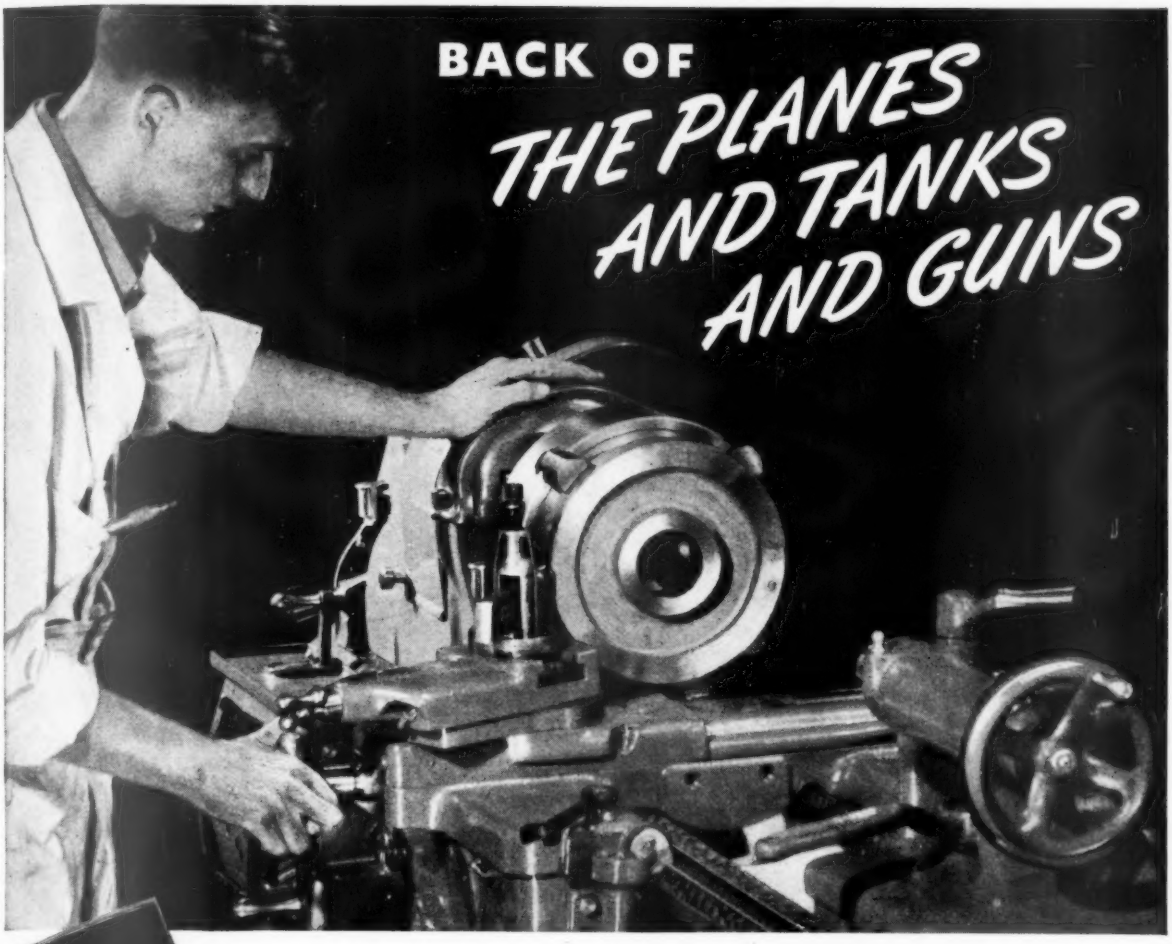
In addition to serving as a heat-transfer mechanism the hydrogen gas serves to cool the tungsten electrodes between which the arc is maintained. It also protects the molten metal and surrounding parts with an envelope of ordinary hydrogen gas which prevents oxidation and leaves a clean, bright-surfaced weld.

For manual atomic hydrogen arc welding, a double-tungsten electrode holder is used. A two-conductor cable and a rubber gas hose carry the welding current and low-pressure hydrogen gas to the electrode holder. The arc struck between the two tungsten electrodes may be shortened or lengthened by a slight movement of the trigger alongside the electrode holder handle. The arcing terminals of the electrodes are surrounded by hydrogen introduced by passages surrounding the electrode.

Hydrogen is usually obtained from an ordinary gas cylinder through a pressure regulator set to deliver gas at about 10 pounds per square inch. A solenoid valve located in the power unit is used to automatically start and shut off the

(*Continued on page* 115)

Butt joint in 1/16-inch 18-8 stainless steel welded by an atomic-hydrogen arc.



All of the South Bend Toolroom Lathes, Engine Lathes and Turret Lathes are described in Catalog 100C. Write for a copy of this new, 48-page catalog.

Buy War Bonds!

Army-Navy Production Award With Two Stars

Back of the planes and tanks and guns that are flowing in ever-increasing quantities to our fighting forces is a skillfully coordinated plan of men and machines — a combination of skill, ingenuity and mechanical perfection that is going to win.

Accuracy is the key to the success of this great plan. Without the split-thousandth tolerances that assure perfect interchangeability of parts, the production goals could not be attained — and not enough planes and tanks and guns would reach the war fronts.

Capable of fulfilling the demands of urgent war production, South Bend Lathes have the accuracy and speed for the most exacting precision operations, plus ruggedness and power for efficient service.

South Bend Lathes are made with 9″, 10″, 13″, 14½″, and 16″ swings in both Quick Change Gear and Toolroom models. Practical attachments are available for special classes of work.

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA — LATHE BUILDERS FOR 36 YEARS

Strip steel is fed into this tube welding machine which forms a tubular shape, seam welds and sizes the piece.

Buick Builds Welded Steel Manifolds

New technique rolls sheet steel strips into tubes—Ingenious machine does the welding.

AUTOMOTIVE engineers of General Motors' Buick Division recently perfected two new contributions to aircraft engine production. One of the developments is a welded steel intake manifold tube which replaces the seamless tube; the other is a "spider web" steel hoop used to test the wiring and timing order of the ignition systems of the radial aircraft engines Buick now is building.

The welded steel tubes are being used as a precaution against a shortage of seamless tubing. Using the methods formerly needed in making the torque tubes or drive shafts of the Buick automobile, these welded tubes are made from sheets of steel rolled into a cylinder and welded by an ingenius machine.

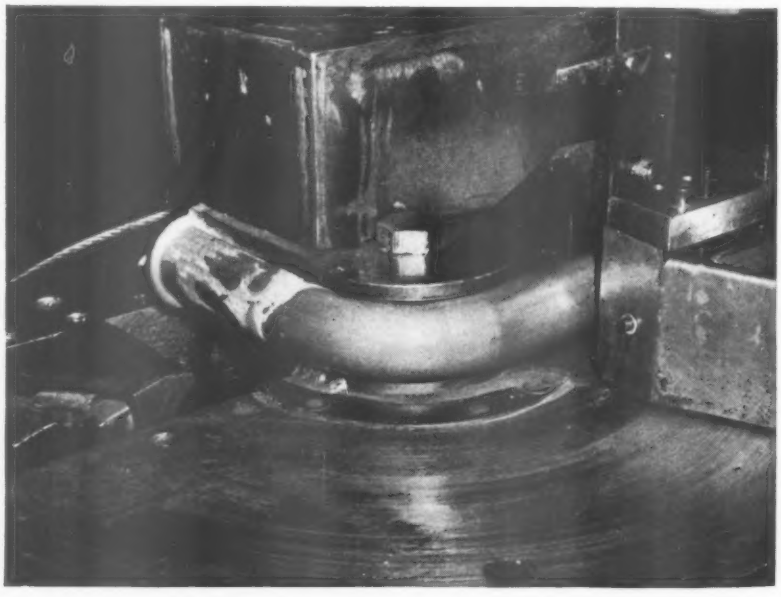
For the engine made by Buick 14 intake pipes are required per engine, seven of which are 2⅜ inches in diameter and 16½ inches long while seven are 2⅜ inches by 18⅜ inches long. All are bent at right angles to lead the fuel mixture from the central manifold to each of the 14 cylinders.

The intake manifold is at the rear of the cylinder banks, so that intake pipes leading the front cylinder bank are longer than those connecting to the rear bank. Otherwise the intake pipes are identical.

The principal problem, according to the engineers, since strength of the welded tubing was an assured factor,

(*Continued on page* 115)

Tube locked in double bending machine which pulls it around central die to form right angle.



YOUNG FLYERS START RIGHT...

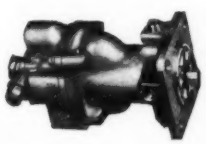
with ROMEC *Pumps in their Trainers . . .*

Young Pilots have confidence in their training ships. And why shouldn't they? Take a look at the Romec pumps in their trainers.

BUY WAR BONDS

ROMEC PUMP COMPANY • ELYRIA, OHIO, U.S.A.

Manufacturers of Aircraft Pumps and Accessories



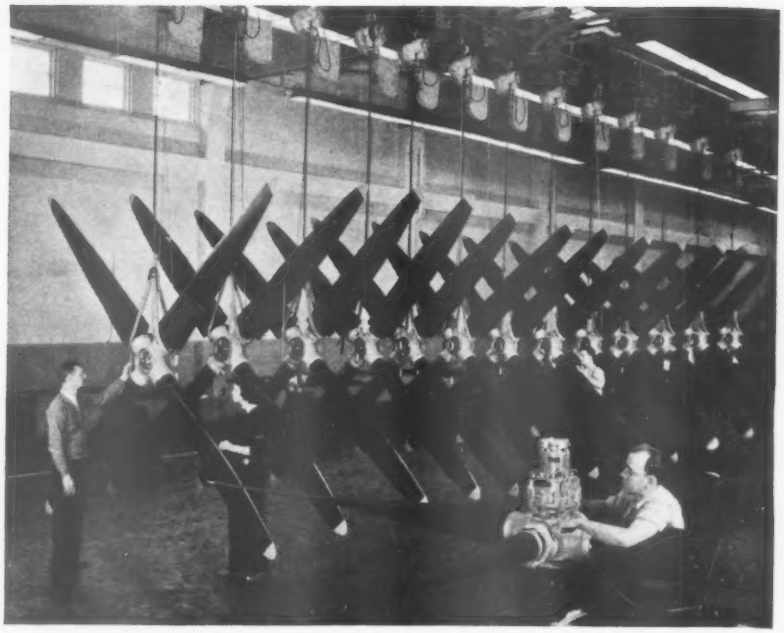
FIRST IN DEPENDABILITY

Romec

Building Curtiss Props

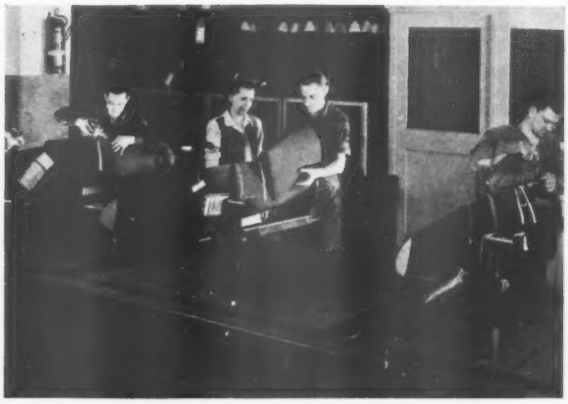
Photographs from Curtiss-Wright

MASS production of aircraft propellers, achieved through the utilization of conveyorized production lines, has become a reality in the Indiana plant of Curtiss-Wright Corporation's Propeller Division. From beginning to end, in the designing of this factory, every effort has been made to speed up production. Parts travel to worker and from processing point to processing point in a steady, seemingly unending stream.

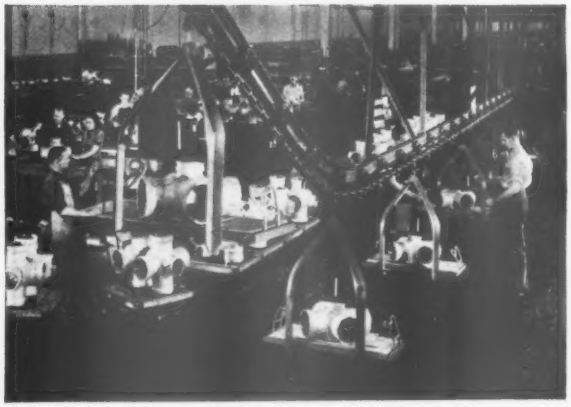


Completed four-bladed propellers, carried on monorail, are being taken to the final balance room. Man (foreground) is installing electrical propeller pitch gear.

Rough spots on the propeller blades are sanded by belt sanders. Dust removal booth encloses the sanding unit.

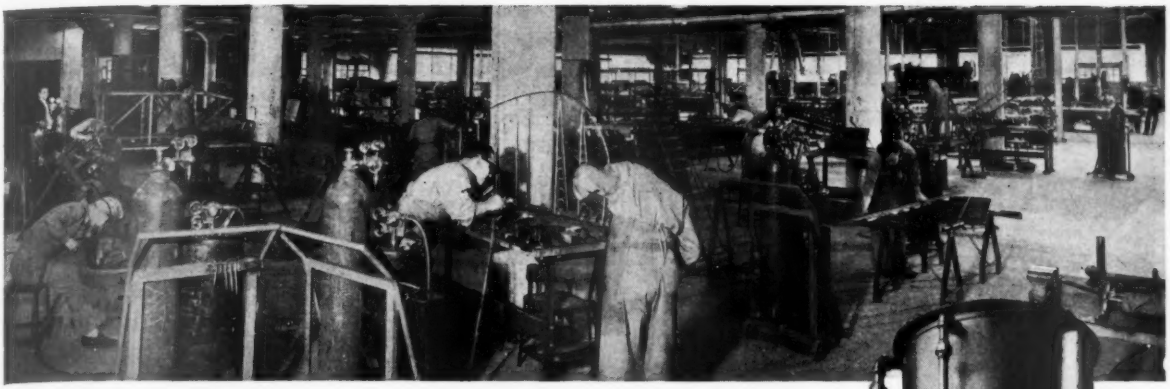


Assembly line workers install the cuffs on the blade shanks. Propellers have already been in paint shops.



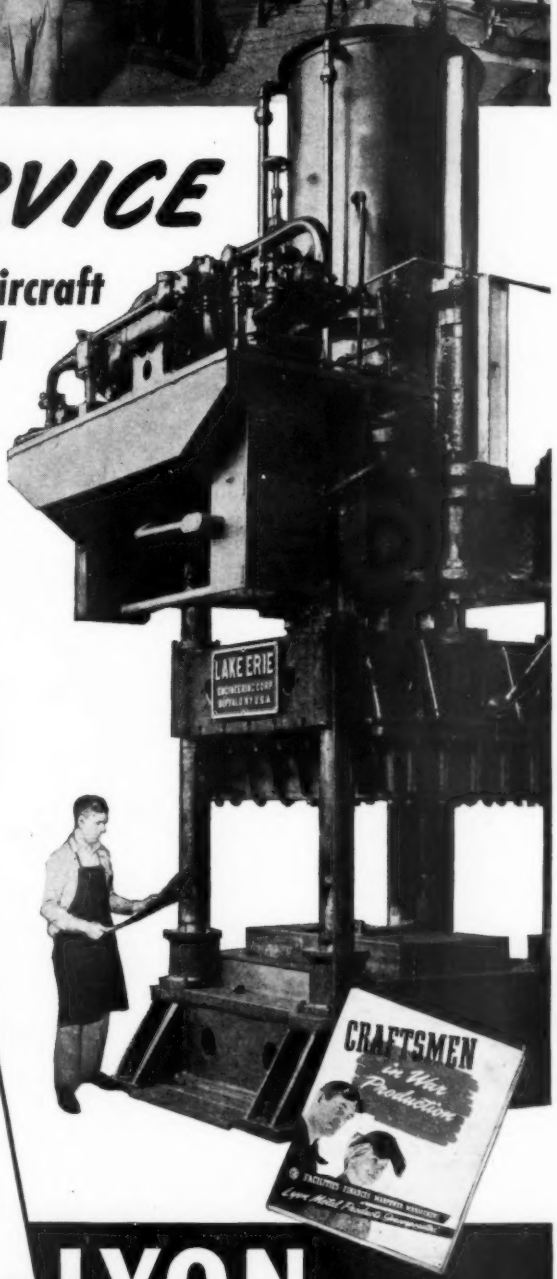
Finished hubs are brought from second story stock room on a special conveyor to the main assembly line floor.

A straight-away view through one assembly line of the Curtiss-Wright prop factory shows efficiency of conveyors.



AT YOUR SERVICE

Open Facilities for Production of Aircraft Parts in Aluminum and Steel



● Lyon is at work on a wide range of contracts for aircraft parts and sub-assemblies in steel and aluminum.

Our modern, completely equipped Aircraft Division is supervised by men specially trained in aircraft plants. Class "A" certified welders trained in our own school are available for all aircraft work. Completely equipped toolrooms, staffed with experienced tool and die makers, are capable of producing dies, fixtures and jigs to meet contract requirements. Lyon has had 43 years' experience in sheet metal fabricating operations. Our war contract experience dates from July, 1940, and we are entirely familiar with Army, Navy and other Government inspection requirements.

Phone, wire or write on your business letterhead for detailed information and book, "Craftsmen in War Production," describing and illustrating Lyon plants and equipment.

LYON METAL PRODUCTS, INCORPORATED
General Offices: 6806 Madison Avenue, Aurora, Illinois
Sales and District Offices Manned by Experienced Engineers in All Principal Cities

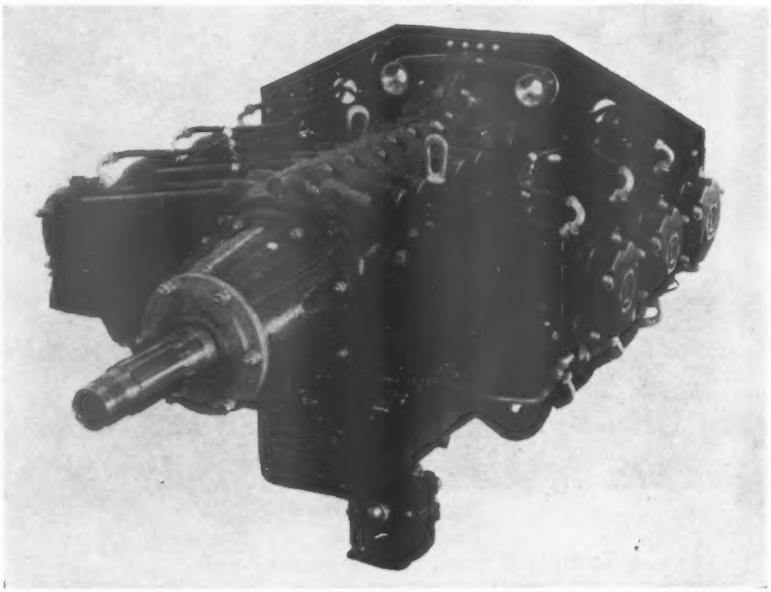
Lyon's Extensive Production Range Includes:

- Hydropress work.
- Brake forming operations—aluminum and steel.
- Hydrogen, acetylene and electric spot welding.
- Routing, swedging and shaping operations.
- Complete assembly work, including both welding and riveting.

LYON
METAL PRODUCTS, INCORPORATED

The 220 H.P. Lycoming GO-435

By
HARVEY MICHAELS



The GO-435 series geared engine, produced by the Aviation Corporation's Lycoming Division, packs 220 h.p. This power plant is available to manufacturers in two models.

The new six-cylinder horizontally opposed engine boasts planetary-type propeller reduction gear.

LATEST in the series of dual ignition horizontally-opposed aircraft engines designed and engineered by the Aviation Corporation's Lycoming Division is a six-cylinder power plant in the 200-220 h.p. class. Designated the GO-435, the new engine is being produced with a self-contained planetary type propeller reduction gear assembled on the forward face of the shaft; the gear ratio of the unit is 77:120.

Presently available in two models—the GO-435 and GO-435-B—the engine has a bore of 4.875 inches and a stroke of 3.875 inches. It measures 29.61 inches in height, 32.32 inches in width and it is 47.70 inches long; weight, dry, with all accessories is 447 lbs. Performance figures show a fuel consumption of 12.6 gallons an hour and oil consumption of .015 lb. per hour.

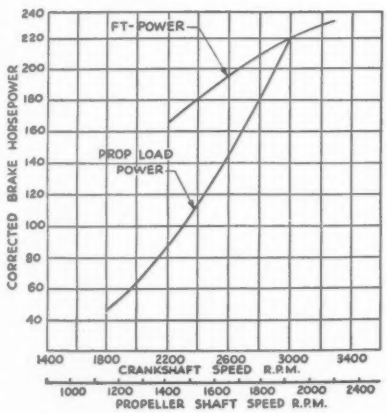
Both models in the series are identical, except that the higher compression ratio of the B engine (7.5:1) coupled with its use of 100 octane fuel, gives it an output of 220 h.p. at 3000 crankshaft r.p.m. (1925 propeller r.p.m.). The companion engine delivers 200 h.p. at 3000 r.p.m., with a 6.25:1 compression ratio and 73 octane fuel. Cruising power is 165 for the B, and 150 for the other model, both performances being attained at 1750 propeller r.p.m.

Structurally, the GO-435 is conventional. Its cast crankcase is aluminum, split vertically along the centerline and bolted with studs which pass through the cylinder base flanges. The crankshaft is a one-piece steel alloy nitrided forging balanced dynamically and statically, and provided with four main bearings. An SAE No. 20 spline is at the end of the gearing portion of the propeller shaft.

Cylinders have aluminum valve-in-head type heads screwed and shrunk into forged steel barrels. Each cylinder is individually removable from the case, and all have exhaust ports which extend vertically downward, thus offering an installation that not only provides maximum visibility, but which also facilitates arrangement of the exhaust system.

Pistons are the permanent mould Lo-Ex cast aluminum type having two compression and two oil rings; piston pins are full floating. The design calls for a forged steel camshaft with hardened cam surfaces. Wilcox-Rich hydraulic type tappets are used, and the entire valve gear mechanism is fully enclosed and lubricated.

Lubrication is achieved by the use of a wet sump system with internal baffles inducing circulation and providing oil cooling. Oil is supplied under pressure to bearings and tappets by a gear-type pump working through an oiling system which is an integral part of the engine's structure.



This chart shows the performance of the GO-453-B using 100 octane fuel.

Use of a center zone induction system provides particularly good distribution of the fuel-air mixture to each cylinder. The system is cast directly in the oil sump and is submerged in oil, thus insuring complete and uniform fuel vaporization as well as adequate cooling of the oil in the sump.

Provision is made for rear mounting, using rubber bushings. There are five points of support, adaptable to a ring type mount similar to that used on larger radials. If desired, however, the engine is available with a platform type of mounting with four points of support.

Equipment includes a Scintilla magneto, Marvel carburetor, Eclipse starter and generator, and Pesco fuel and vacuum pumps.

SPECIFICATIONS
(GO-435-B)

Rated h.p. at sea level	220
R.p.m. at rated power	3,000
Propeller r.p.m. (rated power)	1,925
Cruising power	165
Bore (inches)	4.875
Stroke (inches)	3.875
Compression ratio	7.5:1
Fuel (octane rating, minimum)	100
Overall dimensions (inches)	
Height	29.61
Width	32.32
Length	47.70
Fuel consumption (cruising) gals./hr.	12.6
Oil consumption (cruising) lbs./h.p./hr.	.015
Weight, dry (lbs.)	405
Weight, dry (lbs.), with all accessories	447

IT'S SMOOTHER, SURER STOPS WITH THE NEW SCOTT "B-711" BRAKE PRESSURE UNIT

There's a real feeling of confidence when your heels engage the pedals of the newly-developed Scott Brake Pressure Units. You *know* you come to a smooth, safe stop when and where you want to. That's because these new hydraulic pressure cylinders are positive in action—absolutely fluid-tight—assuring top efficiency from the brake system. Designed for use on light aircraft using the expander tube brakes, these units may be adapted to other braking systems. Readily installed, and located with pedals in conventional relationship to the rudder pedal. Scott B-711 Brake Pressure Units are simple in design, durably constructed, light in weight (only 21 ounces). Each unit is exactingly tested to assure dependable, long-term performance. Economically priced. Write for illustrated folder.

The illustrations below show the locating and simple method of installing the pressure unit in the brake system: (1) Installation on Piper J-3 with floorboards removed showing method of reinforcing and attachment to structural members of fuselage. (2) Close up of left-side pressure unit showing cable extension to front seat brake pedal and attaching clamps. (3) Convenient arrangement of pressure unit pedal, located for easy, positive operation.

Scott AVIATION CORPORATION
LANCASTER, N. Y., U.S.A.
DESIGNERS AND MANUFACTURERS OF SPECIAL EQUIPMENT FOR THE AIRCRAFT INDUSTRY

SUPPLIERS TO THE U. S. ARMY AND NAVY AIR FORCES AND LEADING AIRCRAFT MANUFACTURERS

NEW Equipment

PLYWOOD BINDING NUT

BOOTS AIRCRAFT NUT CORP., of New Canaan, Conn., has developed a self-locking "cage" nut designed to speed production of sub-assemblies of plywood airplanes.

So called because of its bird-cage design, the cage nut is used for fastening metal to wood. It incorporates the wing style, all-metal, self-locking principle and may be applied blind from one side by a single operator.

The basket mount of the nut is collapsed with a special clinching tool. The collapsed mount then clinches the plywood in a claw-like grip which withstands the torque applied when a bolt is inserted.

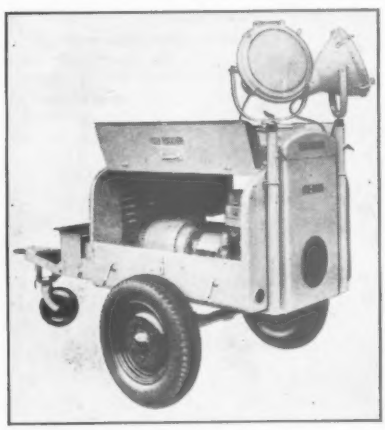
The tool is adjustable to varying thicknesses by the use of stop arrangements and effectively sets the mount into plywood from thicknesses of 1/16th of an inch and up.

TIME SAVER

THE suggestion of a maintenance department employe of the Fisher Body Works, Detroit, Mich., Elmer H. Isaacks, has resulted in a lubrispray gun that enables a machine oiler to more conveniently lubricate a press gear.

Such a device could be built by other plants where gears of large presses must be lubricated constantly, Fisher officials said. Primary object of the grease container is the saving of time, and it is so constructed that the oiler can carry it over his shoulder by a sling, enabling him to climb a ladder instead of waiting for a crane to lift his greasing equipment up to him in order to reach the gears.

The lubricating gun is made of two three-quart light metal grease containers fitted with easily fastened and removable lids. The center of each lid has a ⅜ inch pipe thread opening for a like-size pipe bushing. The bottom of the containers have a ¾ inch pipe thread opening for a similar size bushing. A metal follower is used to follow grease through the container. Gun nozzles and air control fittings can be arranged from plant supplies.



Lister-Blackstone aircraft engine starter.

HYDRAULIC TEST BENCH

A HYDRAULIC test bench utilizing a simplified and improved arrangement of proven principles to test hydraulically operated actuating devices has been developed by R. Voigt and Son Co., Buffalo, N. Y.

The benches are individually designed and built to meet testing specifications and production schedules usually set up by the Army and Navy. These requirements demand a definite range of low pressures for testing operations and high pressures for leak and burst tests. In addition to this, the size of the product to be tested as well as the production schedule, determine the size of the working surface and special fittings necessary.

Because of its large liquid circulating system, over 30 gallons per minute under pressure, a group of up to 20 units can be tested simultaneously. In this way great savings in time are made.

Where greater production facilities are needed or larger parts are to be tested, the working surface is enlarged to meet that need. Two benches are often used together to permit setting-up and testing simultaneously.

Actual operation is simple. Controls are handy and easy to use. Gauges are large and easily read.

The bench is rugged, and has built-in, sealed oil tank, oil filter, oversized piping, quality valves and fittings.

PORTABLE STARTER

A PORTABLE aircraft starter unit has been developed by Lister-Blackstone, Inc., of Milwaukee, Wis., to provide power for starting all electrically started planes by simply plugging a line to the aircraft's control panel.

According to the manufacturer, this unit can deliver a constant voltage during the starting cycle. Balky aircraft engines can be "rolled" continuously and the unit also can be used for turning over engines in the maintenance shop.

Mounted on a trailer, the outfit has a direct current electric generator which will deliver up to 500 amperes at both 12 and 24 volts. Power is supplied by a four-cylinder gasoline engine.

"Thor" drill now has plastic housing.

PLASTIC-COVERED DRILL

DEVELOPED by the Independent Pneumatic Tool Company, of Chicago, a ¾ pound plastic-covered drill has recently been placed on the market. Speed adaptable for all types of heavy-duty production work, the drill delivers more power per pound than any steel or metal drills now on the market. Principle feature of the drill is the plastic covering which is mounted over a skeleton steel frame. There are three speeds available: 2,500, 3,750 and 5,000 r.p.m.

SOLVES CLEAN UP PROBLEM

A NEW floor masking material has been developed by the Turco Products, Inc., of Los Angeles and Chicago, which should speed up the clean up jobs in paint shops and factories. The new discovery, a white, thick liquid which looks and handles much like paint, can be quickly applied with a kalsomine brush to the walls and floors of the building. Drying quickly, it leaves a hard surface which will stand ordinary foot and truck traffic.

When the accumulation of paint and grease becomes so great that it must be removed, the Turco Duramask coating on the walls can be dissolved with a stream of water and the paint and grease film can then be mopped away.

Voigt hydraulic system tester.

Traffic Lights --At Sea!

After the war flares projected from ships can be "hung in the sky" by parachute to guide storm-tossed mariners.

THAT age-old invention, the parachute, has many modern commercial purposes beyond its indispensable place in aviation. Mail, medicine, industrial materials, food—yes, even eggs—all have in recent years been successfully delivered by parachute. Wartime developments have opened many new horizons for the parachute industry. By constantly redesigning and improving our 'chutes, by incorporating more safeguards, finding better materials, developing better production methods and lowering costs, Switlik has taken the lead in establishing the place the parachute will occupy in the industrial life of the nation after the war.

FIVE REEL SOUND FILM 16MM—*"Parachutes for Safety" may be had for a one-day showing by schools and colleges upon request. This unusual film describes the manufacture, packing, service, maintenance and use of parachutes. For data please write on letterhead to:*

SWITLIK PARACHUTE COMPANY TRENTON, NEW JERSEY

SWITLIK
Safety Chutes
FOR WAR AND PEACE

NOT all war assignments are in far-off places. Nor are they all on battlefields.

There's many a vital war assignment right within the continental bounds of the United States ... in the plants and factories that turn out the implements and weapons of war.

Fleetwings' assignment, for example, is in Pennsylvania. Here, men and women build planes and plane parts to sweep the Axis from the skies.

How well Fleetwings' men and women are doing their job ... how fast they are turning out the many wings, fins, ailerons, stabilizers, flaps, tail assemblies, fuselage sections, and hydraulic valves they're building ... is evidenced by the Army-Navy "E" burgee that flies over Fleetwings' Plant Number One.

But the men and women at Fleetwings aren't satisfied merely to fill their war assignment. Even now, on Fleetwings' drafting boards, there are plans being completed which indicate that the battle being fought today, will not have to be re-fought tomorrow. With Victory, Fleetwings will be ready with the planes and plane parts to help win the Peace.

(Plant No. 1)

FLEETWINGS

Division of Kaiser Cargo, Inc.

BRISTOL • PENNSYLVANIA

FLEETWINGS

pioneers with parts and hydraulic equipment

The BT-12, all-welded basic trainer built for the U. S. Army Air Forces.

ONE OF FLEETWINGS' newest time-savers is a sponge-rubber and hardwood roller to be used during taping operations. With this device the operator is able to keep his hands from continually being covered with finishing dope and to cut taping time nearly 50% over the conventional manual method.

FLEETWINGS' HYDRAULICS DIVISION got its original impetus because a certain hydraulic valve needed for the pioneer all-steel airplane, the Fleetwings "Seabird," could not be bought on the open market. From designing and building one valve, this division has now grown so large that it is producing hydraulic valves that control the landing gear, bomb doors and wing flaps on many of America's fastest fighting planes.

VICTORY GARDENING, to help relieve food shortages, is another activity at Fleetwings. Early this Spring, the company made garden tracts available to all employees who desired them. The response was tremendous. Now-a-days, after work, you'll find scores of Fleetwingers busy in their garden plots adjoining plant number two. They feel that growing what they eat is still another way to "keep 'em flying."

TO GET YOUR COPY of Fleetwings' monthly magazine, "The Arrow," merely write to us on your company stationery. In this magazine you'll find articles about production shortcuts, and other information of interest to men and women in the aircraft industry. Address your request to "The Arrow," at Fleetwings, Bristol, Pennsylvania.

"KEEP 'EM FLYING!"

FLEETWINGS

Division of Kaiser Cargo, Inc.

BRISTOL • PENNSYLVANIA

Welding Process

(*Continued from page* 104)

gas flow when the arc is started and stopped. Where it is anticipated that the consumption of hydrogen will be high, an ammonia dissociator can be obtained to furnish a mixture of 3 parts hydrogen and 1 part nitrogen—produced by the dissociation of ammonia into its constituents.

Electric power for the arc is furnished by a special transformer-and-control combination. This unit permits setting the welding current at the exact value desired, by means of a crank at the top of the assembly. Contactors and control relays built into the equipment remove all power from the electrode holder when the arc is out. A push button located at the welding station permits striking the arc when welding is begun. This applies power to the electrode holder and opens the hydrogen gas valve which controls the flow of gas.

Automatic atomic-hydrogen arc welding equipment may have a single arc, or several arcs in tandem. The multiple arc equipment is used to obtain welding speeds in excess of that obtainable with a single arc, and to provide close control of the cooling cycle of the molten pool and the surrounding base metal.

In these equipments, a small motor or motors drive the two tungsten electrodes together and apart as much as is necessary to strike the arc, maintain the proper arc length, and compensate for the gradual consumption of the tungsten electrodes. Each motor is controlled by an electronic tube panel which responds to slight changes in arc voltage and causes the motor to run in the proper direction and at the proper speed to correct the voltage by changing the arc length.

The technique employed in manual atomic hydrogen arc welding is similar to that used in gas welding.

END

Manifold Tubing

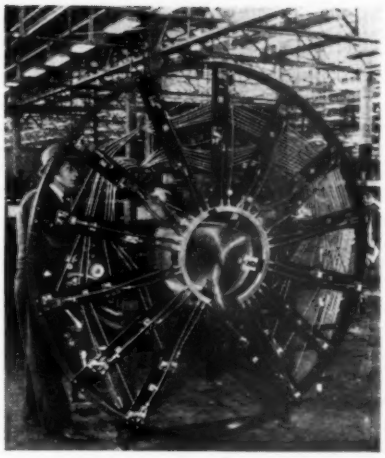
(*Continued from page* 106)

was bending the welded tubing at right angles at the same time maintaining uniform diameter at the bend free from wrinkles and distortion that occur during the bending operation. This was accomplished by designing locking dies in a crank press and a series of six steel chaser balls and one sizing ball. The bent tube is placed in the lock dies and through it are rammed by a means of a plunger on the ram of the press the six steel balls which smooth out the wrinkles and distortions and size the formed piece accurately.

The welded pipe thus processed provides uniform wall thickness essential to the function of the part and eliminates wall pockets that might retard the flow of fuel mixture to the cylinders, and in this respect, is an improvement over former methods.

The welded tube intake pipes are formed from a coil of S.A.E. 1010 strip steel. A spot welder is used to weld together succeeding coils of steel which is fed into six roll stands to form the tubular shape, then through a seam welder and finally through four more rolls for accurate sizing, and then to an automatic cutoff at the end of the line. The equipment performing these continuous operations is the same that was used to produce automobile torque tubes.

To form the elbow shape, the tube section is flanged at one end and normalized, after which it is locked in a standard type tube bending machine which pulls it around a central die to form a right angle. Metal strain is great in this operation, but good quality steel and a special lubricant have reduced scrap to a minimum.



This Buick testing ring detects faulty ignition systems in aircraft engines.

The "spider web" steel hoop, with a maze of tubular-covered wires running from its outer edges to a panel on one side, is designed to test the wiring and timing order of ignition systems.

It is an accurate and infallible check against defective wiring in the ignition system and is the means of eliminating, prior to engine test, loss of vital time in the testing of engines.

As part of inspection routine, the ignition system's connections are attached to marked clamps on the circumference of the ring, each clamp representing the correct cylinder for a mated wire. When high voltage of engine frequency is passed through the system, sparks jumping across spark gaps on the panel indicate whether the wiring system under test is in order. An unactivated spark gap shows broken or faulty wires. The ignition system is also subjected to a lower voltage as a double check in the search for faults.

To inspect the firing order of the ignition system, the device has a series of lights on a control panel which become illuminated when the magneto block for each bank of cylinders is hooked up to a distributor and the distributor rotated by a hand crank.

END

Ack-Ack guns that "see, hear, and think"

MEN who man our anti-aircraft batteries swear that their ack-ack guns can "see, hear, and think." Here's why:

In case of a night air raid, the first ears to hear the enemy bombers are mechanical ones in the Sound Locator developed and continually improved by Sperry. Far more sensitive and reliable than human ears they can locate enemy planes while they are still many miles away and determine their exact position and the direction of their flight.

When the "ears" have found the planes, the "eyes" of the ack-ack guns take over. A battery of 800 million beam candle-power searchlights, the most powerful in the world, spotlights each enemy raider *automatically*. So brilliant is the light of this Sperry invention that a man miles away can read a newspaper by it.

While the reaching finger of the searchlight follows the plane across the sky, the "brain" of the guns goes to work. This is another Sperry device, the Universal Director.

Working many times faster than the human mind, this uncanny instrument calculates firing data and transmits them to the anti-aircraft guns electrically. Then a Sperry power control mechanism automatically positions the guns on the target.

The last act in this amazingly swift-moving drama comes when the men slam home the shell and press the firing lever. Which they do. And enthusiastically!

Creating "eyes, ears, and brains" for anti-aircraft guns is but one of the many ways in which Sperry is co-operating with our Army and Navy, and helping through precision engineering to solve the problems of a nation at war.

Sperry Gyroscope Company, Inc.
Brooklyn, New York
Division of Sperry Corporation

SPERRY

PRECISION ENGINEERS TO AMERICA

Will Peace Come In Our Time?

Most certainly it will—and sooner than you may expect. With it will come the crucial test of whether or not American industry can convert as efficiently to peace as it has to war. From our extensive relations with hundreds of varied manufacturers we know of scores of amazing new products that only await the message of peace to come into being. Everyone looking ahead to that great day can even now count on the assistance of the Weatherhead plants which are producing vital parts for planes, tanks, ships, cars and trucks at the rate of *millions every day!*

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FLIGHTEX SUPERIORITY IS NO SECRET

In fact we're broadcasting the formula: The men and women of Suncook Mills build Quality, Service and Dependability into every yard of FLIGHTEX fabric. No wonder each year more manufacturers buy more FLIGHTEX than any other airplane fabric.

World's Premier Airplane Fabric

FLIGHTEX FABRIC

FLIGHTEX

SUNCOOK MILLS — 40 Worth St., New York

Export Representative—Aviation Equipment & Export, Inc. 25 Beaver St. N. Y. Cable Address— Aviquipo

Leading Manufacturers of Fabric and Tapes for the Aircraft Industry

RESALE DISTRIBUTORS

AIR TRANSPORT EQUIPMENT, INC., Roosevelt Field, Garden City, N. Y.
INTER CITY AIRLINES, East Boston, Mass.
THE AIRCRAFT STEEL & SUPPLY CO., Wichita, Kan., Fairfax Airport, Kansas City, Kan., Dallas, Tex.
SNYDER AIRCRAFT CORP., 5036 West 63rd St., Chicago, Ill.
LEAVENS BROS. AIR SERVICE, LTD., Barker Airport, Toronto, Canada
VAN DUSEN AIRCRAFT SUPPLIES, Wold-Chamberlain Airport, Minneapolis and Chapman Field, Waterloo, Iowa.
KARL ORT, York, Pa.
AVIATION SUPPLY CORP., Hapeville, Ga.
PACIFIC AIRMOTIVE, Burbank, Cal., Oakland Airport, Oakland, Cal.
AERONAUTICAL TRADING CO., 167-24 Rockaway Blvd., Jamaica, N. Y.

AIR SERVICES SECTION

A Douglas "Dragon" (B-23), with pick-up arm extended, about to take two 15-place gliders into tow from the ground.

"ONE-WAY JOHNNIE"

By JOHN STUART

The Army's glider pilots are headed for action under the Troop Carrier Command's supervision.

Photographs from the War Department

THE Army's "One-Way Johnnies" are now headed the right way. Whatever may have been the confusions that led the boys in the glider schools to adopt, somewhat ironically, the "one-way" title, responsible officers in the War Department now believe they are on the way to become not only a mighty useful cadre of specialists, but among the world's fightingest all-'round soldiers.

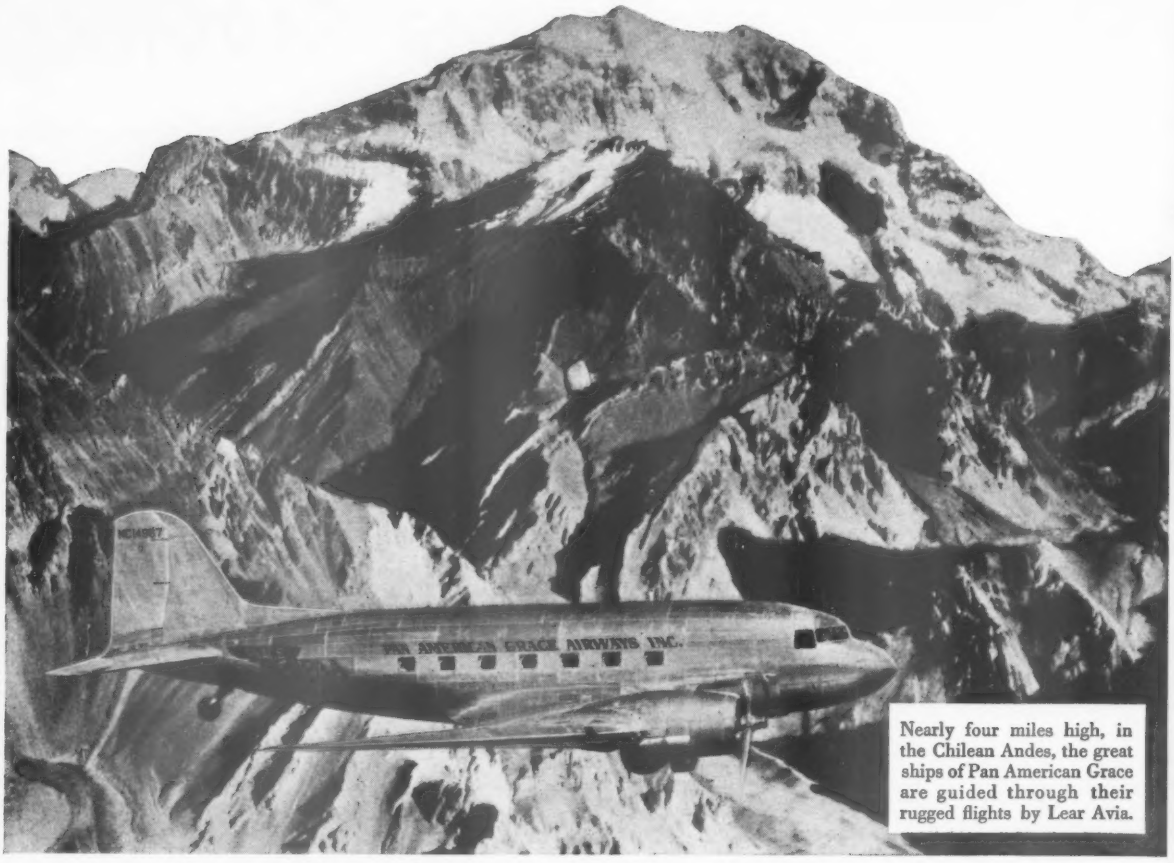
It is admitted that there may have been a good deal of confusion in the minds of the glider students themselves. The art of "dead-stick flying" was perhaps over-glamorized for them. Certainly there got abroad a popular idea of vast fleets of silently soaring planes *about* to wreak havoc in the enemy's rear. Just what the havoc was to be or how it was to be wrought was not clear. But the romance of that soaring menace was pretty potent stuff. Certainly too many boys, according to the Army's present plans, got imbued with that romance.

The Army's plans are now hard-boiled down to detailed specifications from the theater commanders in each of our theaters of operations. The glider aspirants are likewise being boiled down. Likewise they are going through a screening process. Some few of them, bitterly disappointed, are being put back in civilian life. Some few others will find themselves still in the Army, but far removed from glider operation. But responsible officers in Washington insist that the proportion of those thus disappointed will be small.

For, those not needed for the boiled-down glider pilot program are being shunted wherever possible to kindred activities where their native or acquired skills will not be wasted. Some are headed for training as service pilots with the Air Transport Command; some for liaison jobs with the artillery; some for the central instructors school at Randolph Field; and some for officers candidate schools. The tests being applied to them are in this order: (1)—is he a potential pilot; (2)—will he fit in an air crew as bombardier, navigator or gunner; (3)—will he be a good ground crew man, armorer, mechanic, etc.; and (4)—has he administrative abilities that head him for an officers' candidate school?

Interviews with Air Force's officers fail to reveal cancellation of contracts for the construction of gliders. There have been a number of changes in the kind of gliders various manufacturers are making

(*Continued on page* 122)



Nearly four miles high, in the Chilean Andes, the great ships of Pan American Grace are guided through their rugged flights by Lear Avia.

"With Lear Avia Equipment, TRIPS THAT WERE DRAMATIC ARE NOW ROUTINE"

— PAN AMERICAN GRACE AIRWAYS INC.

THROUGH some of the strangest flying conditions on earth, the radios and direction-finders of Lear Avia safeguard the ships of the Pan American System over much of South America.

A shipment of 300,000 doses of sulfadiazine is Clippered to stem an epidemic of meningitis in Chile.

Nine days by muleback from Quito, capital of Ecuador, is a work-camp where unarmed laborers were recently attacked by savage Aushiris Indians. By radio a call for help went out to Quito. Rifles, ammunition, medical supplies and food were carried by plane and dropped at the camp after only an hour's flight.

Yes, "trips that were dramatic are now routine", thanks to Lear Avia!

Famous pilots who use Learadio in their planes include: Clyde Pangborn, Major Al Williams, Major Alexander P. deSeversky, and Bob Hall.

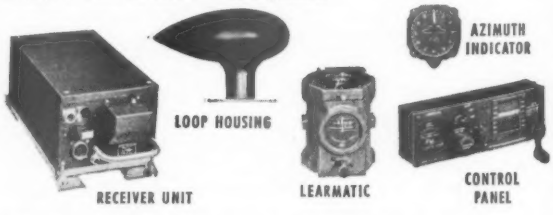
Learadio, *"the pilot's preference,"* is now standard equipment on the better known aircraft including Grumman Amphibians, Wacos, Fairchilds, Cessnas, and most civilian and air cadet pilot training aircraft and itinerant types used in the service of the armed forces.

Ninety-eight percent of Lear's Production and Engineering facilities are today concentrated on projects of a secret or semi-secret nature. Automatic Electro-mechanical controls of Lear exclusive design are incorporated in aircraft manufactured by Consolidated, Douglas, Boeing, Lockheed, North American, Vultee, Grumman, Curtiss-Wright, Ford, General Motors, etc., now in combat on the world's battlefronts.

* * *

The making of precision products on principles developed by Lear's war program of research and invention is developing peacetime applications in many consumer fields in addition to aircraft.

The Lear ADF-8 Automatic Direction Finder fulfills all requirements of the modern air navigator in radio reception and direction finding. Everything you need — at your finger tips. Everything you want to know — at a glance.



The Lear ADF-8 combined with the Learmatic Navigator is a new basic instrument for navigation of aircraft. It ushers in a new era in air safety. Designed by pilots for pilots.

The Learmatic Navigator concentrates the entire navigational problem on a single dial; gives graphically its running solution; guides the pilot along his chosen track and brings him to his destination, and if need be to a safe landing; reduces pilot fatigue; and achieves greater safety in the air through greater precision of navigation.

LEAR AVIA, INC.

PIQUA, OHIO

HOLLYWOOD, CALIF. • GRAND RAPIDS, MICH. • CHICAGO • CLEVELAND • NEW YORK

BATTLE-BORN • BATTLE-TESTED • BATTLE-PROVEN
SUPERIOR INSTRUMENTS FOR TOMORROW'S FLYING

Somewhere on some front, a huge motorless ship silently settles behind an enemy outpost and from its bowels—on the double—swarms a squad of air-borne infantry full of mustard and mayhem. That's *Waco's* contribution to this war . . . nine- and fifteen-place gliders . . . designed by *Waco* . . . built by *Waco* and more than a dozen other prominent plane manufacturers.

On another front, a thousand miles away, a flyer hits the silk. Thanks to a bare-legged stenographer in Indianapolis or Philadelphia . . . he'll live to fly again. And somewhere at sea, a sailor clings to his tiny life-raft. Thanks to someone's rubber tires . . . *your* rubber tires . . . he'll sail again to Murmansk.

That's the way it is in this war. We all have a hand in its winning . . . and when its history is finally written, each page will bear the imprint of some one of us. We can think of no title for this story so appropriate as "How to Win Wars and Influence Dictators" . . . no dedication so fitting as "To 130,000,000 Americans."

WACO AIRPLANES

THE WACO AIRCRAFT COMPANY • TROY, OHIO

Douglas "Skytrain" towing a CG-4. Glider pilot training ranks are being thinned by an exacting screening test.

(*Continued from page* 118)

and these, for obvious military reasons, are not being talked about. But responsible officers point to this as the best evidence of the fact that the glider program as a whole is now full throttle ahead. They say, further, that the screening process through which aspirants are being run is such that only those are being dropped who would have washed out subsequently in any event.

Pre-glider, elementary and basic training through contractors under the CAA has been suspended for the time being. But the Army's own advanced and combat training at Bowman Field and elsewhere is being expanded and developed to meet the special needs which direct reports from the front indicate as desirable.

Have the gliders been in action yet? Our military men meet that question with a blank stare.

"The enemy let the British find out for themselves when they used gliders," one officer said. "Let's let the enemy find out when *we've* used 'em."

Whether or not they have already been used, it is certain that they will be used. The whole glider program, it should be noted, is now under the Troop Carrier Command. That is pretty good indication of how they will be used.

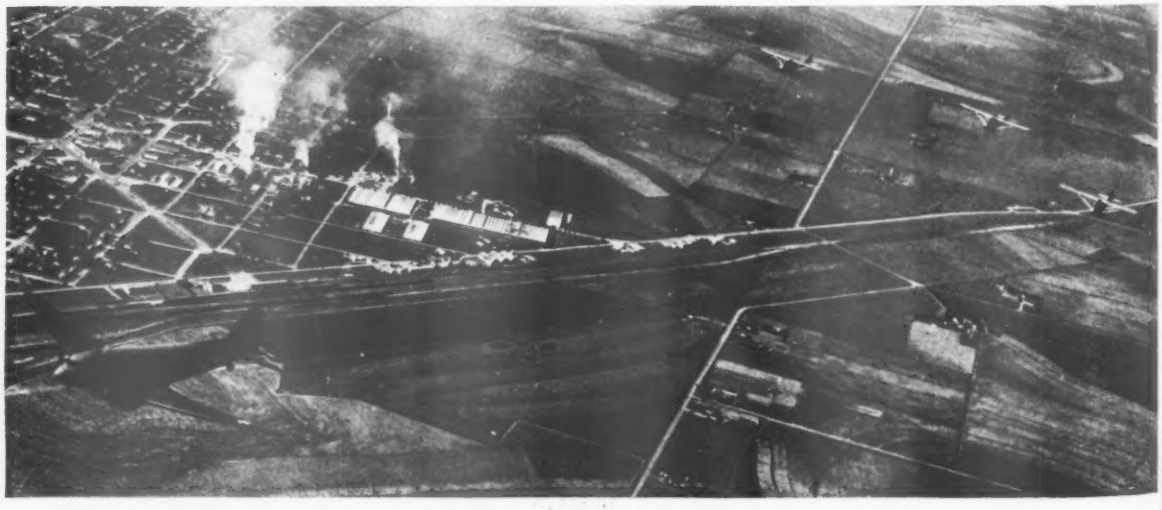
For the glider, in its present military conception, is a far cry from the sportsman's soaring or sailplane, which was perhaps responsible for the glamorous concept of what the glider of the immediate future will be. German experience probably discolored this public concept. In the days when military flying was taboo in the Third Reich, the Luftwaffe was nourished surreptitiously by Germany's hundreds of gliding, soaring and sailplaning "sportsmen's" organizations. Our own glider development is under no such necessity of camouflage. Perhaps the best measure of its seriousness is the fact that the jobs on which our boys are now working carry their heavy loads to the ground at a gliding angle less than one-third that of the average sailplane or soaring glider. In other words it is not their job to "fly through the air with the greatest of ease." It is their job to get down on the ground as fast as possible and get in there and fight.

This is the concept which now colors the whole of our glider program. The glider pilot is not, in our book, the graceful young man on the flying trapeze. He is a tough soldier. He is a leader of men. He must not only be a master of the dead-stick art; he must be capable of putting armed men in the right place on the ground and of leading them as a ground combat officer in the toughest kind of ground fighting with all kinds of arms and armor.

The big tactical gliders with which our boys must work have already been pretty fully described. Few people realize that in size they are practically as big as a DC-3 transport plane. Yet these big fellows must be set down in places which,

(*Continued on page* 130)

Years ago the towing of three gliders simultaneously was an air show stunt; now it is part of Army's training program.



MASSED MIGHT ...

Prodigious in heft and brawn, supreme in speed and punch, squadrons of 2,000-h.p. *Republic P-47 Thunderbolts* excel in sheer destructive power. No altitude is too great, no enemy too fast or too strong, for these stalwart fighting units of the U. S. Army Air Forces.

REPUBLIC AVIATION

AIR MASTERY THROUGH ENGINEERING EXCELLENCE

REPUBLIC AVIATION CORPORATION — REPUBLIC AVIATION — FARMINGDALE, L. I., NEW YORK

★ ★ FOUR STARS ★ ★

AND A STREAMLINED STAFF

IF Billy Mitchell is watching this war from some celestial observation craft, he must have grinned considerably on March 19. That was the day the President made Henry H. Arnold a full general, the first air officer to win four-star rank. And the Senate of the United States broke all speed records to confirm the nomination unanimously and by acclamation the day it came up.

It was a significant promotion for "Hap," the ever-smiling but hard-headed and canny commanding general of the Army Air Forces, for it set the final seal on the all-but-independent status the AAF has achieved under his command. It's pleasant to recall, too, that "Hap" was Mitchell's close friend.

Announcing his promotion, the War Department said four-star rank for Arnold was required by his position as a member of the Combined Chiefs of Staff, and was in addition "a recognition of outstanding accomplishment."

Arnold's promotion was followed ten days later by the long-expected announcement of a reorganization of the AAF headquarters staff. Under the enormous pressure of the war, the staff and command functions had multiplied in a number of loosely coordinated sections, and while the AAF's growth was gaining momentum, there was never time to "catch up."

Now, however, with plans complete and operations running smoothly, the much needed realignment has been accomplished. Some details, particularly as to individual assignments, remain to be clarified, but in general the AAF now has a staff organization completely geared to the war job.

As a result of the realignment, Headquarters, AAF, is relieved of details of execution and left free to deal with over-all policy. A more cohesive organization exists at headquarters, greater authority is delegated to field commanders, and the number of personnel in Washington will be reduced somewhat.

Instead of 25 headquarters offices, there are now 13, and instead of 19 components of the Air Staff as formerly, there are now only six. Special staff officers, however, are increased from four to five.

Arnold's own headquarters staff, under the new organization, consists of the Chief of Air Staff, Maj. Gen. George E. Stratemeyer, and the latter's three deputy chiefs of staff and six assistant chiefs of staff. The deputies, who will exercise control over various field commands at the direction of Stratemeyer, are Brig. Gen. T. J. Hanley, Brig. Gen. LaVerne Saunders and Brig. Gen. William E. Hall.

ACME

Gen. Henry H. Arnold, the first air officer to be given four-star rank.

The assistant chiefs of staff are: Maj. Gen. Oliver P. Echols, for materiel, maintenance and distribution; Maj. Gen. Barney McK. Giles, for operations, commitments and requirements; Brig. Gen. O. A. Anderson, plans; Brig. Gen. R. W. Harper, training; Brig. Gen. J. M. Bevans, personnel, and Col. E. P. Sorenson, intelligence.

This staff, with its various assistants and subordinate commanders, will reach the policy decisions, and transmit directives to the field commanders. Heretofore, these field commanders have been required to forward a multitude of questions to Washington for decision by the centralized command. That will no longer be true—in the words of the announcement, "components in the field will, in short, be told what to do but not how to do it." The explanation was added that the field commands have now been stabilized sufficiently to manage the details of execution. The picture of over-all AAF activity is no longer fluctuating as it did in the war's early days.

In addition to his six assistants and three deputies, the chief of air staff exercises direct control over the new Office of Management Control, headed by Col. Byron E. Gates, which concerns itself with statistics and with headquarters business and organizational methods; the Flight Control Command, which under Col. Samuel R. Harris absorbs the former Air Traffic and Safety Directorate and the AAF Communications and Weather Services, and the Special Staff—Office of Special Projects, Col. F. Trubee Davison; Air Inspector, Maj. Gen. Follet Bradley; Air Surgeon, Brig. Gen. David N. W. Grant; Budget and Fiscal Officer, Brig. Gen. Lee Miller, and Air Judge Advocate, Col. E. H. Snodgrass.

Under Assistant Chief of Air Staff Echols come the Materiel Command, in which Echols has been succeeded by Brig. Gen. Charles E. Branshaw; the Air Transport Command, headed by Maj. Gen. Harold L. George; the Air Service Command, under Maj. Gen. W. H. Frank; and the base services—Air Ordnance, Chemical Warfare, Engineer, Finance, Quartermaster and WAAC officers and the Air Provost Marshal.

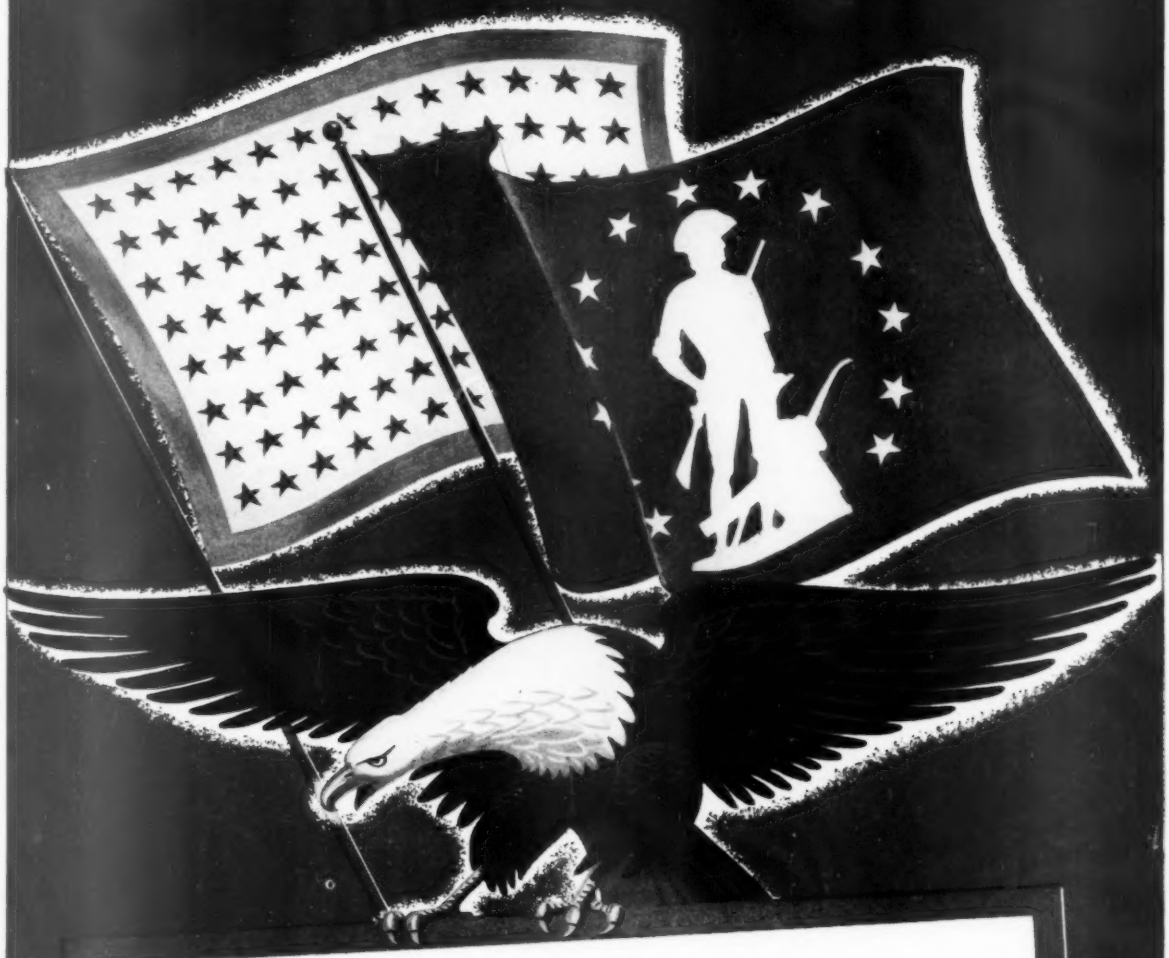
Giles, as assistant chief of air staff for operations, commitments and requirements, has under his command War Organization and Movement, the Proving Ground Command headed by Brig. Gen. Grandison Gardner, the Anti-Submarine Command under Brig. Gen. Westside T. Larson, the School of Applied Tactics headed by Brig. Gen. Hume Peabody, and the 12 operational Air Forces.

Jurisdiction over the operational Air Forces, of course, is limited to technical supervision. For administrative and tactical purposes, they operate under the tactical orders of the commanding officers in theaters of war. The two non-operational Air Forces, the 2d and 3d, are devoted to training activities, and as such are under the direct command of the Commanding General, AAF, exercised through the Assistant Chief of Staff for Training, Gen. Harper. In addition, Harper's jurisdiction extends to the Flying Training Command, under Maj. Gen. Barton K. Yount; Technical Training Command, headed by Maj. Gen. Walter R. Weaver; Troop Carrier Command, under Brig. Gen. Fred S. Borum. The 2d Air Force, commanded by Maj. Gen. Davenport Johnson, trains heavy bombardment units and other units assigned to it in combat crews. Maj. Gen. St. Clair Streett heads the 3d Air Force, which trains medium, light and dive bombardment units and replacement crews.

The detailed organization of these various headquarters components has not yet been made public. Neither have the specific duties of the remaining assistant chiefs of air staff, but their jobs are sufficiently indicated by their titles—Plans, Personnel and Intelligence.

END

In the Nation's Service



WITH every effort dedicated to the nation's service, the men and women of Breeze are turning out an ever-increasing volume of vital equipment for war. Such products as Breeze Radio Ignition Shielding, Cartridge-Type Engine Starters, Multiple Electrical Connectors, Flexible Conduit and Fittings and Aircraft Armor Plate are but a few of the many well-known Breeze items now in action with the United States Army, Navy, and Air Forces.

Breeze employees are doing their part on the economic front as well, contributing 10% and more of their pay for War Bonds. At the same time many hundreds of Breeze workers have gone into uniform to fight on battlefields the world over. To them our pledge is a pledge of production—total production for ultimate Victory.

BREEZE CORPORATIONS, INC. • NEWARK, NEW JERSEY

Breeze BREEZE MARK

—from the engineering that produced the Lightning and the Hudson!

THEY'RE VASTLY different ships, but our Army's P-38 Lightning and the RAF's Hudson bomber have this in common—both are products of Lockheed engineering skill, both demonstrate the *stamina* that is a by-word for Lockheed. Fastest-climbing, longest-range pursuit ship in this war, the Lightning has shown it can take punishment as well as dish it out. And the Hudson was a transport with so much guts it was made over into the RAF's "maid of all work"—a bomber that can dive like a fighter, fast enough to catch an enemy sub in frantic efforts to submerge.

America is proud of Lockheed's accomplishments — and proud of the engineers, technicians and workers who have shown such outstanding ability at two such totally different jobs: designing, engineering and building for their specific wartime assignments not just one but *two* of the American planes that are helping United Nations forces all over the world. America can look with assurance toward Lockheed's future, too, when United Nations skyships will cruise the trade lanes of a world at peace.

CONTROL CORDS need plenty of stamina, to pull a diving aircraft into a climb, or just for routine flying. Here, at Roebling, we make them with the care and skill that prepares them for unfailing functioning in both kinds of operation. John A. Roebling's Sons Company, Trenton, New Jersey. Branches and Warehouses in Principal Cities.

NAMES the U. S. must never forget

AERONCA
AIR CRUISERS
BEECH
BELL
BOEING
BOWLUS
BREWSTER
CESSNA
COLGATE
COMMONWEALTH
CONSOLIDATED
CULVER
CURTISS-WRIGHT
DOUGLAS
FAIRCHILD
FLEETWINGS
FLETCHER
FORD
G & A AIRCRAFT
GENERAL MOTORS
GOODYEAR
GRUMMAN
HOWARD
INTERSTATE
★ LOCKHEED
MARTIN
McDONNELL
NORTH AMERICAN
NORTHROP
PIPER
REPUBLIC
RYAN
STEARMAN
TAYLORCRAFT
TIMM
VEGA
VOUGHT-SIKORSKY
VULTEE
WACO

In these frequent messages, Roebling salutes each member of the aircraft industry in turn.

ROEBLING

means Control in the air

U.S. Army

RAF ceremonial flags were presented to Maxwell Field's Brig. Gen. W. W. Welsh by Group Capt. H. A. V. Hogan.

RAFers Leave

THE last RAF cadets recently graduated from Maxwell Field, Ala., and headed for action or training posts outside this country. These boys were among the last class of Royal Air Force cadets to be trained in the United States.

The only British cadets still in this country are those who have not yet completed their training or who are taking highly specialized courses which perhaps they could not take elsewhere.

Hails CAP

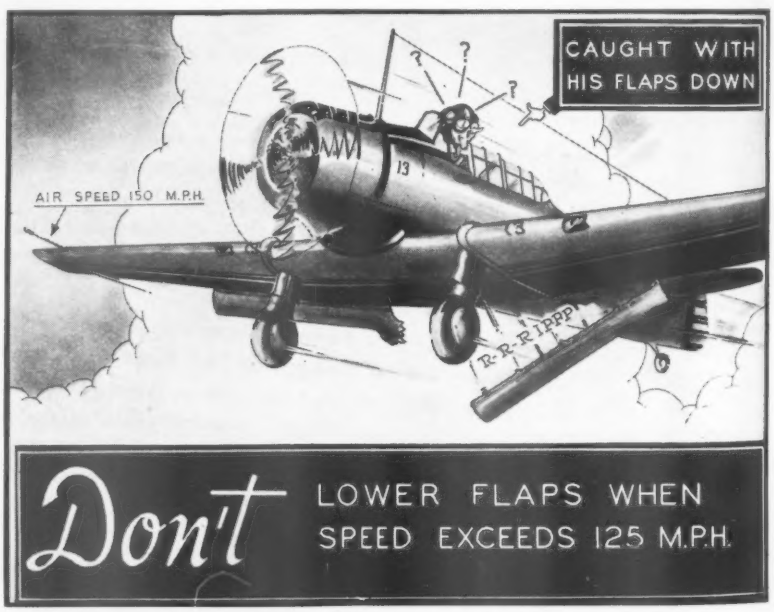
LAUDING the work of the CAP, Rep. Hatton W. Summers on the floor of the House of Representatives recently spoke of the work of an "organization which has tendered their service and the service of their planes to the Federal Government . . . when enemy submarines were working havoc in our coastal waters." He added in part:

"The CAP was brought into being . . . by the universal demand of the civil airmen of the U. S. to be utilized in the war effort. In this spirit, private pilots at municipal airports and hayfield landing fields mobilized.

"The flying minutemen flew their little ships to hastily improvised bases. They brought their own radios, repair parts, tools and equipment, starting from scratch to fly their landplanes over the winter ocean . . . with no more protection than their kapok life jackets. This coastal patrol has been maintained ever since, regardless of the weather.

"The discipline of this organization is shown by the fact that although the planes on CAP coastal patrol have been carrying a heavy load of bombs for months, the first thing the public knew about it was when an official announcement was made. . . .

"In much the same way, the patrol has been manning inland missions on an increasing scale now approaching that of the coastal patrol and potentially much larger . . . thousands of miles are being flown each day on regular schedule to carry dispatches, urgent shipments, and key officers between widely separated military posts; to fly tests of the air raid warning system; give sighting practice to antiaircraft gunners, tow aerial targets over the fire of guns and for many other purposes.



No. 6 in the series of specially prepared drawings which are being used by the Army Air Forces to impress upon cadets what "not to do" while in an airplane.

2 DATES THAT MADE HISTORY IN STRUCTURAL PLYWOOD

1917

The lightweight structural strength of wood veneers laminated and molded to curved forms in one-piece, was proved by Henry Haskell of Ludington, Michigan, a quarter of a century ago. His experiments led to the building and sale of the one-piece canoe bearing his name. The fact that some of these canoes are still in regular service after twenty-five years provides an impressive demonstration of the durability of this lightweight construction. From this pioneer one-piece shell to the structural strength required in modern aircraft was a logical step.

1937

The Fairchild F-46 was the first successful plane of the molded plywood type. It was a development stemming from continuous research in plywood since the early experiment with Henry Haskell's canoe. This modern molding technique, now patented, is called "Plymold" by Haskelite and "Duramold" by the Fairchild Engine and Aircraft Corporation.

In 1942 after hundreds of hours of operation under all sorts of conditions for five years, the synthetic finishes used to protect the wood of the F-46 were sanded down and the plane found to be standing up perfectly.

HASKELITE MANUFACTURING CORPORATION
Grand Rapids, Michigan
CHICAGO • DETROIT • NEW YORK

HASKELITE

PLYMOLD MARINE PLYWOOD AIRCRAFT PLYWOOD

Plymetl Phemaloid

"Thunderbolts" land lightly on AEROLS*

Capable of a power dive in excess of 725 miles per hour, Republic's P-47 "Thunderbolts" are considered the fastest high altitude fighters in the skies. And their "ground performance" is equally superb —for "Thunderbolts" are equipped with AEROLS.

Not only "Thunderbolts," but every other type of American aircraft—from the modest sized trainers to the biggest bombers—rely on Aerols for swift, sure take-offs and soft, cushioned landings.

●

THE CLEVELAND PNEUMATIC TOOL COMPANY
AIRCRAFT DIVISION • • CLEVELAND, OHIO

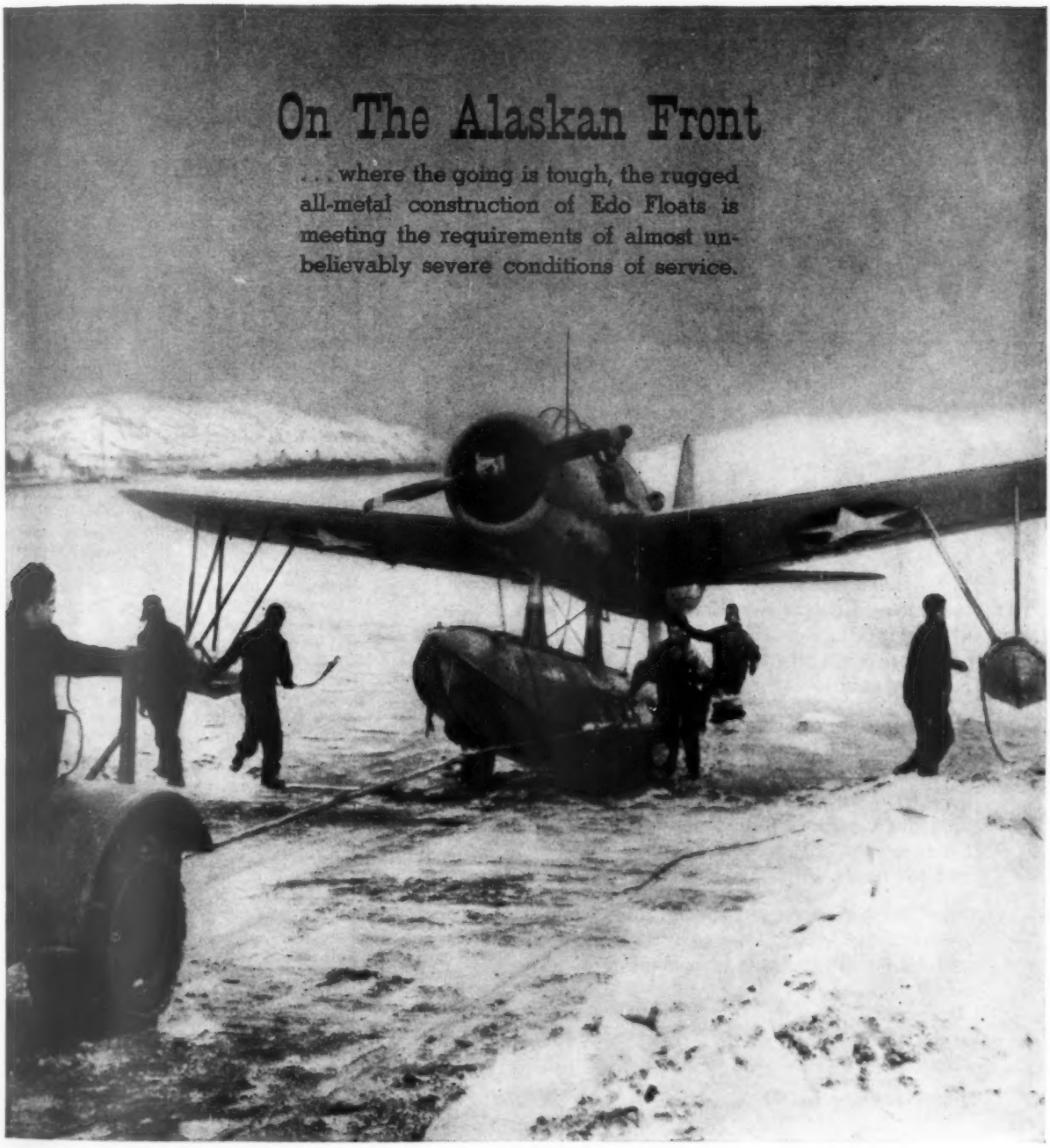
Also Manufacturers of Cleco pneumatic tools for the aircraft and general industry, Cleco sheetholders, Cle-Air shock absorbers for trucks and buses, and Cleveland rock drills for mining and construction work.

AEROLS*

*THE SHOCK ABSORBING UNITS ON AN AIRPLANE'S LANDING GEAR; THE NAME IS DERIVED FROM THE WORDS "AIR" AND "OIL"—THE FLUIDS USED TO DISSIPATE THE LANDING SHOCKS

EDO FLOAT GEAR

SERVES THE UNITED NATIONS


On The Alaskan Front
. . . where the going is tough, the rugged all-metal construction of Edo Floats is meeting the requirements of almost unbelievably severe conditions of service.

★ ★ ★ ★ ★ EDO manufactures single and twin Float Gear for the aircraft of the U. S. Navy, U. S. Army Air Forces and leading Foreign Governments.

Edo Aircraft Corporation, 414 Second St., College Point, N.Y., U. S. A.

All are included **in the Plomb Line**

In Plomb's complete line of supreme quality hand tools for all industries, the socket and attachment group alone includes hundreds of kinds and sizes. Equally complete — equally outstanding in quality — are all other types of tools that bear the famous Plomb name.

Their excellence has made them the choice of professional mechanics — has resulted in such gigantic demand that 36 separate factories operate night and day to fill war needs. Thus, Plomb tools in ever-increasing volume are available thru dependable dealers all over the country to help make weapons faster and better — and to maintain those weapons at peak efficiency.

In addition, if you need special tools for special war needs consult Plomb. And remember, for regular tools call the Plomb dealer in your neighborhood.

PLOMB

Fine Hand Tools for All Industries

PLOMB TOOL COMPANY

LOS ANGELES ▽ CALIFORNIA

One-Way Johnnie

(*Continued from page* 122)

a few years ago, would have been deemed impossible for the smallest plane.

Nor is that all. A dead-stick landing in a small field is but the beginning of the job. Gliders work in groups. Once down, the glider pilot must get his craft out of the way of those who follow him into these small landing spaces. He must, for the protection of the troops and equipment he carries, get his plane immediately into shelter and concealment. He must, therefore, not only be able to make his powerless landing in a small space, but he must have enough momentum left on the ground to taxi, still powerless, to the precise point where he ought to be. The astonishing accuracy with which this can be done has already been demonstrated publicly at Bowman Field and other places.

Furthermore, these gliders are not clay pigeons as they float, or rather dive, for their ground objectives. They come in fighting. In fact the firepower available from a big glider loaded with heavily armed troops, against either attacking planes or as strafing power against enemy ground troops, is one that a whole formation of Stukas might envy.

There is no tendency among responsible officers in Washington to underestimate German possibilities in the glider field. But, in view of the progress that has been made in our own program, these officers are puzzled by the lack of any report that the Germans have recently used this method of attack. Perhaps, they think, when the Luftwaffe got down to the business of the "short war" for which it seemed generally to have been designed, German glider resources in both men and materiel were quickly exhausted. Our officers are not, however, sitting back on the comfortable theory that the enemy will not be able to renew such forces.

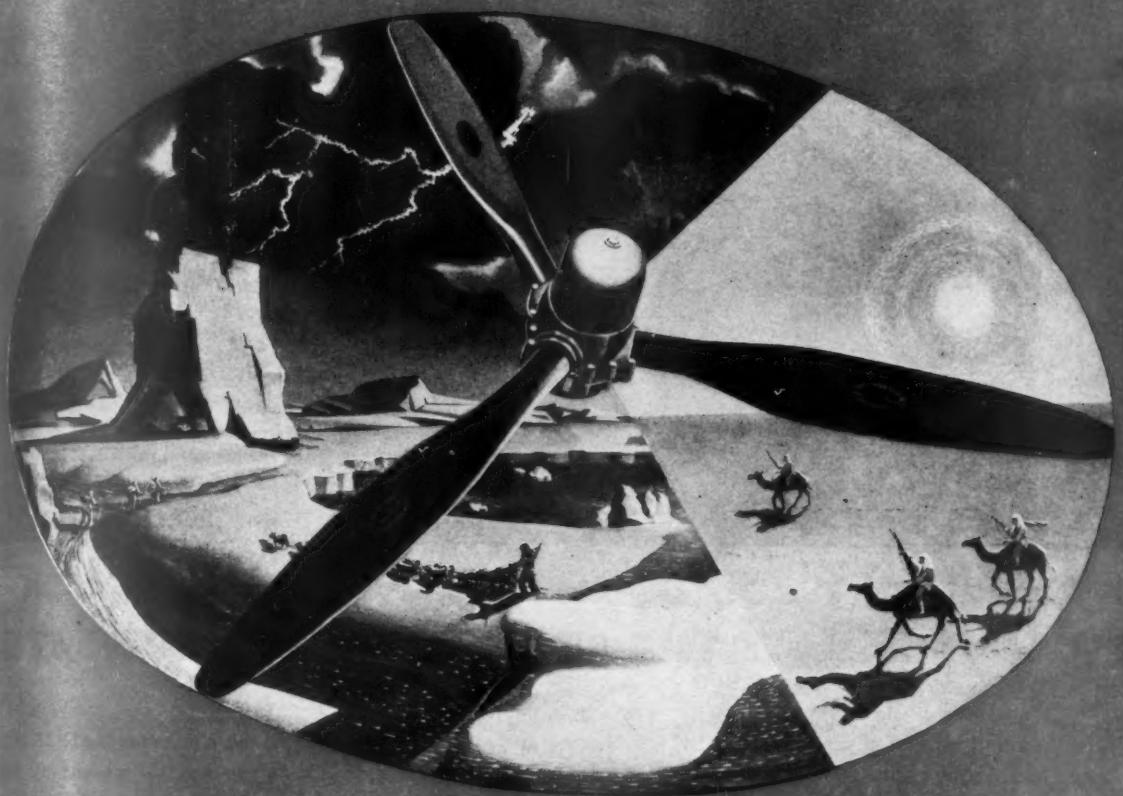
They are, on the other hand, convinced that we are well on the way to create powerful forces of our own. It is pointed out that not a single military glider had ever been authorized by Congress until the fall of 1941. Yet, by the fall of 1942, a useful tactical type of glider had been designed, tested and put into production in the hands of many manufacturers. Furthermore, the men to fly them on completion were trained and on hand.

The Air Forces, too, are proud of the way that good start has been continued. There have been a few casualties among glider pilots. But Washington headquarters points with justifiable pride to this record of tactical skill—in many hundreds of thousands of man-hours of glider flying so far, not one single passenger in a glider has even been injured!

So the one way of "One-Way Johnnie", they say, is certainly not that path of glory that leads but to the grave. He is headed straight ahead on the way that leads to military usefulness. He may be expendable. But he will exact a heavy price for it if and when he goes.

(*Continued on page* 135)

NEITHER SNOW NOR RAIN NOR HEAT . . .—



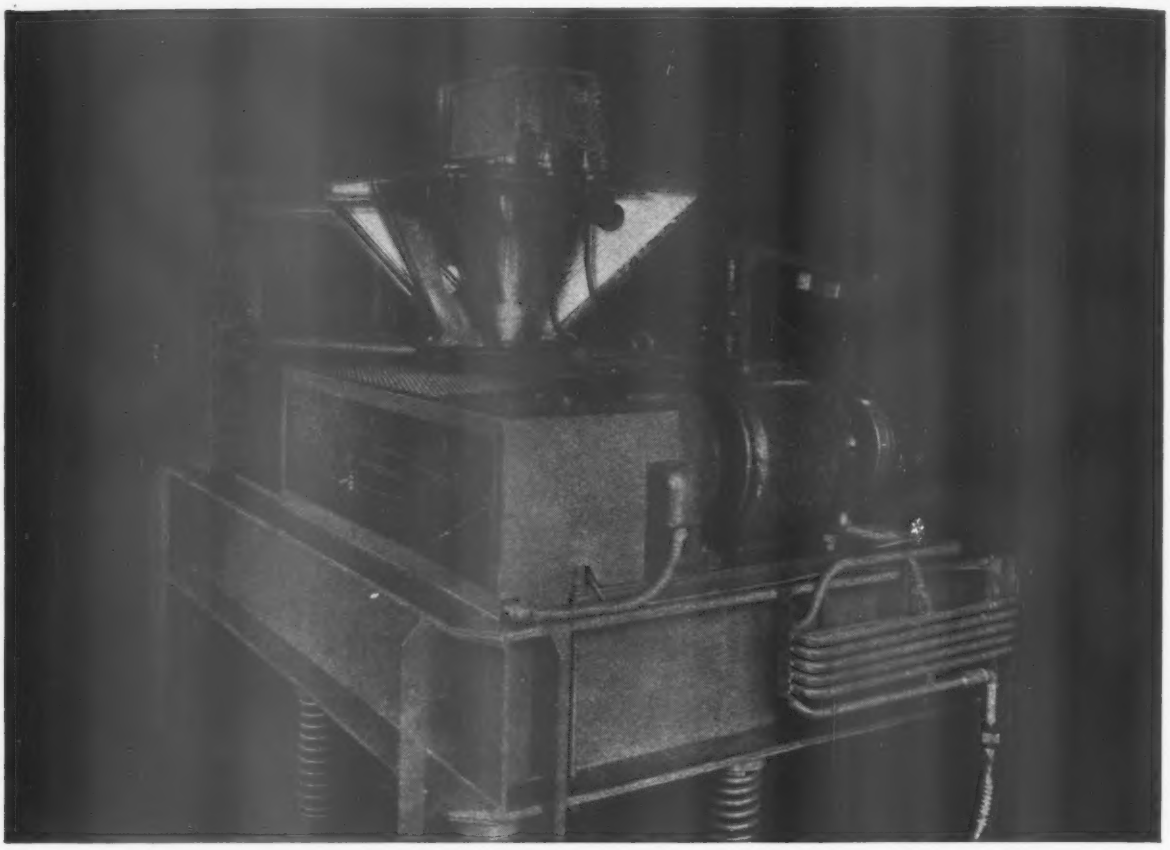
Bitter cold, raging storms and blistering heat are all taken in stride by Pan American Airways as it speeds vital war materials north, south, east and west to the far corners of the earth.

Dependable Hamilton Standard propellers, standard equipment on its huge transports, function perfectly through all these extremes of weather.

HAMILTON STANDARD PROPELLERS

EAST HARTFORD, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION



TWO YEARS AT THE FRONT!...IN TEN MINUTES

Three thousand times a minute the aircraft radio equipment atop this machine lives through an acceleration that would cause the toughest young airplane pilot to "black out" in dive bombing. In a few minutes it lives through the jars and vibrations it would receive on ten round trips from Washington to Chungking. If there is a structural weakness in its design it shows up instantly; *before* it goes into service.

This is the largest and most powerful of the various types of vibration machines used by RCA in the development and production testing of aviation radios. It can duplicate the vibration of the smallest plane or the mightiest bomber. It can re-create the tremendous vibration strain caused by one motor being shot from a bomber, or by the diving of a plane with 250 pounds of radio at *ten times* the force of gravity! — In fact, within three minutes the RCA vibrator can shake into pieces any radio set made — and it would probably shake down the building if its 6-ton concrete and steel base weren't mounted on those giant springs.

Thus, RCA research helps to make RCA's aviation radio equipment become more powerful, more effective, and more dependable, in performing its vital tasks.

RCA

RCA AVIATION RADIO

RCA Victor Division • **RADIO CORPORATION OF AMERICA** • Camden, N. J.

ACHIEVEMENT OF A SINGLE PURPOSE

A SINGLE purpose spurred the engineers who planned the Allison engine.

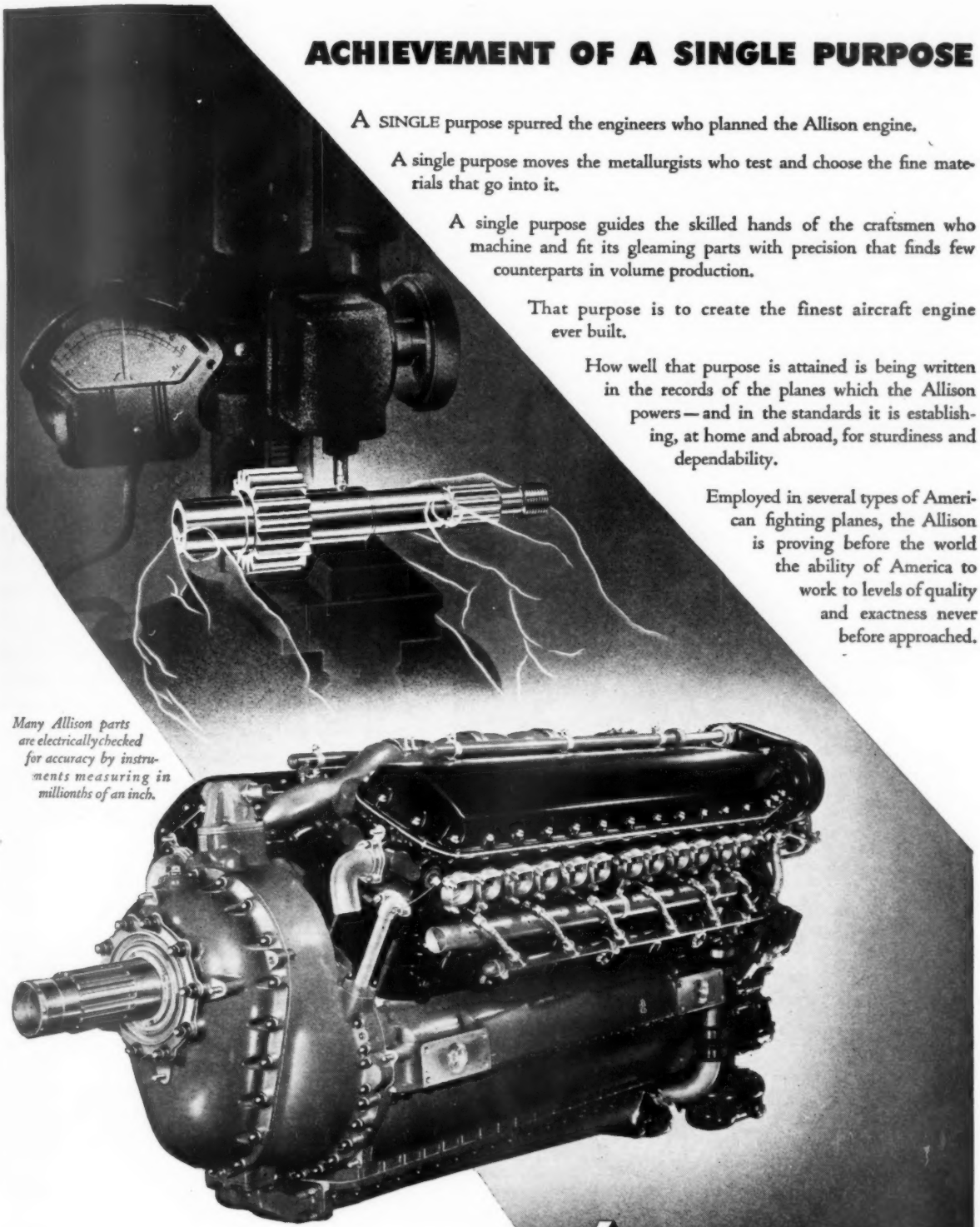
A single purpose moves the metallurgists who test and choose the fine materials that go into it.

A single purpose guides the skilled hands of the craftsmen who machine and fit its gleaming parts with precision that finds few counterparts in volume production.

That purpose is to create the finest aircraft engine ever built.

How well that purpose is attained is being written in the records of the planes which the Allison powers—and in the standards it is establishing, at home and abroad, for sturdiness and dependability.

Employed in several types of American fighting planes, the Allison is proving before the world the ability of America to work to levels of quality and exactness never before approached.



Many Allison parts are electrically checked for accuracy by instruments measuring in millionths of an inch.

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF GM GENERAL MOTORS

SNAP-ON TOOLS

THE CHOICE OF AVIATION

"Because They Best Fill The Bill"

In every branch of aviation . . . in airline maintenance and overhaul . . . in engine and parts manufacture . . . and along the industry's great assembly lines . . . Snap-on tools are used, preferred, endorsed. Because they are designed and built to meet aviation's need for speed, accuracy, extreme flexibility. Because, in the words of Bell Aircraft Corporation:

"The compactness of advanced aircraft design such as Airacobra requires flexible tools that are strong and reliable. We use Snap-on tools because *they fill this bill best* for Bell Aircraft Corporation."

"Filling the bill best" for aviation . . . meeting the urgent needs of factory, assembly line and of America's Flying Forces . . . is today a prime responsibility of Snap-on. Write for catalog of 3,000 Snap-on tools, and address of a nearby Snap-on factory branch.

SNAP-ON TOOLS CORPORATION
8024-F 28th Avenue KENOSHA, WIS.

(*Continued from page* 130)

There is not even a certainty that "One-Way Johnnie" can continue to keep with appropriateness his ironic name. For tactical study has already revealed that once a glider force is set down in a given place, it may be desirable to move in more with the same gliders, or to change the position of troops already thus landed. And the means of doing this—the glider pick-up system—is attracting topside attention.

"I stood up the other day in a glider that was picked up by a power plane," one officer said. "It wasn't half as bad a jerk as you get in these Washington street cars when they start. I kept my feet with little difficulty."

There are still many problems of equipment and the use thereof to be worked out in connection with pick-up. But there are a good many years of quiet experimentation by the duPonts and others to draw on. And the project is receiving increasing study from the men who make our grand strategy.

The President himself has said that that strategy rests upon the invasion of Europe. The glider program, with all its possible developments, is an obvious method of breaching the walls of men and materiel and machines that Hitler has disposed about and above his defense perimeters. If, despite the magnificent work of our bombers—past, present and future—it still remains true that the man who wins wars is the man who stands on the ground with a bayonet in his hands and says "This land is mine"—that man, unlike the Greek hoplite, the Roman legionary or the British square, may well be airborne in effective thousands and the Army already knows that he can be effectively borne in gliders.

Of that there can be not the slightest doubt. And the way of "One-Way Johnnie" is, in the Army plans, the way that wins battles—"Forward!"

The whole operational training program has now been centralized in the hands of Capt. H. A. Wise, veteran of All American Aviation's pick-up systems and of the Army Air Force's Air Support Branch. A glider enthusiast from 'way back, aspirants for training in this service can rest assured they will get, through Captain Wise, all that the strategic and tactical requirements can call for.

END

Triple-Threat Men

TRIPLE-JOB men will soon be graduated from Army Air Forces schools under a new training plan announced by Maj. Gen. Barton K. Yount, commanding general of the AAF Flying Training Command.

Under the plan, outstanding graduates of bombardier schools will be selected and sent to gunnery and navigation schools, giving them training in three phases of heavy bomber operation. When two graduates of this triple-training are stationed on the same plane during long flights, one can relieve the other. While already in operation, this course of study is expected to be widely expanded.

His Dependable "Mike" Keeps Him in Constant Touch with His Fighting Friends

On a dangerous mission far from his base . . . isolated from his fellows by clouds or enemy attack . . . the military flyer has this inspiring reassurance: his words, spoken into the dependable, sensitive microphone, will be heard instantly by scores of fighting comrades.

Kellogg microphones, made to the high performance standards of the Armed Forces, are serving our fighters not only in planes. In rumbling tanks, speeding command cars, in combat vehicles of every type, at airports and ground stations, their sensitivity, ruggedness and accurate transmission qualities are in the thick of battle.

Into their manufacture goes the same specialized engineering skills—the same precision methods of manufacture—that have made Kellogg an honored name in the whole field of communications for almost half a century!

Also Flying with Our Fighters—These and Other Kellogg Products

KELLOGG SWITCHBOARD & SUPPLY CO.
6630 So. Cicero Avenue, Chicago, Illinois

WANTED—Sub-Contract Orders for Microphones and Other Military Communication Equipment
Prime or sub-contractors of the U. S. Government will find Kellogg fully qualified to produce microphones and associated precision communication equipment. This 46-year old firm has the facilities and manpower to handle contract orders for hand, throat and palm microphones; telephone and radio earphones; volume control and switch boxes; multi-contact plugs and sockets; capacitors and other components for radio, telephone and telegraph equipment.

KELLOGG
WHERE ENGINEERING AND RESEARCH BUILD
Finer Communication Equipment FOR WAR AND PEACE

C26S—Shielded

CHAMPION SPARK PLUGS

have a heritage established by world speed records on land, water and in the air, gained over many years past, which makes them right at home in our fastest fighter planes. Because of their unfailing dependability in life or death situations, Champions are daily gaining new prestige with the men of our air forces.

C26—Unshielded

PERFORMANCE

Our fighter pilots are writing fabulous history. Legendary feats are being reported daily from all combat areas. Their planes are without equal in performance, maneuverability and speed, and they know how to use these qualities to the limit. Champion Spark Plugs play their vital part in an ever increasing number of these planes, as well as in other types used by our Air Forces.

The reasons for the ready acceptance and use of Champions in aircraft engines of every size and type are basic. It is directly due to certain inherent features of design and construction, plus special ceramic insulation with the following exclusive service advantages:

CONSTRUCTION

1. Immunity from heat and chemical reactions.
2. Freedom from fuel, oil, or moisture absorption which causes "shorts".
3. Inherently high heat conductivity with consequent wider range between pre-ignition and fouling.
4. Absolute uniformity of material.
5. Homogeneous structure eliminates air spaces which cause current leakage.
6. Easily cleaned and serviced—no specialized equipment or factory returns necessary.
7. Scientifically controlled manufacture.

USE CHAMPIONS AND FLY WITH CONFIDENCE

The New Fairchild Cargo Plane Will Speed Delivery of Tanks, Guns, Troops and Supplies

On that fateful December 7th, Washington opened the drawer marked "Blueprint For a Global War."

"Here's your kind of a job, Fairchild—to develop a plane that can help supply an army on the other side of the world."

Fairchild has that job because of 20 years of aeronautical research and engineering experience in "Creating the Plane for the Purpose." Among those planes is a notable line of cargo-carrying aircraft.

Today, Fairchild is building a new cargo plane designed expressly for carrying tanks, guns, troops and equipment over great distances for delivery *to small fields* at the front! Its precise performance and other characteristics are military secrets.

"ON THE BEAM"

"The independence and liberty you possess are the work of joint councils and joint efforts, of common dangers, sufferings, and successes."
—Geo. Washington's Farewell Address

Buy U. S. War Bonds and Stamps

It was created out of the needs of this war to fulfill the needs of this war. It bears the Fairchild "Touch of Tomorrow."

Other Fairchild "weapons" for winning the war include the famous Cornell primary trainers (PT-19, and PT-26) and the new Fairchild-Duramold twin-engine advance gunnery trainer (AT-21), all powered by Ranger Aircraft Engines. And while the new Fairchild military cargo plane is the latest of these "weapons," it is by no means the last.

Fairchild Aircraft *Division of Fairchild Engine & Airplane Corporation, Hagerstown, Md.*

How to Beat the Japs . . .

(*Continued from page* 101)

100 yards from the bombers. I shot down another, but didn't see it burn for I was already busy with another one. Colonel Cooper in the lead bomber confirmed the first one for me later.

"We stayed back there 45 minutes with complete air superiority. They sent up 45 planes from Canton and Kai Tak and we shot down 24 to 28 with many probables never confirmed. The Japs again had really lost face.

"I dove on White Cloud airdrome over Tien Ho through the blackest and heaviest ack-ack that I've ever seen. It rocked my ship like a small boat. Down on White Cloud I could see a big plane unloading passengers. I was going so fast I couldn't hold the rudder properly for accurate shooting, so my first burst missed the crowd coming out the door. On my next pass they were gone, but I had slowed down. The ack-ack raised hell all about me, but this time I held my sights on the engines and put about 200 rounds of fifties into the Junkers Ju-52 tri-motored transport. On my third pass I'm pretty sure it began to burn, but the dust may have deceived me.

"I shot up a staff car scurrying about the hangar area, and then headed for Kweilin. Holloway shot down a twin-engined fighter 50 miles from the target.

"I landed with little gas and counted the holes. Guess I was skidding too much for the AA but I know the enemy meant to aim well. That afternoon we got everything together for our final raid and watched anxiously for two missing pilots. They soon came straggling in. So it was 28 to nothing, not counting the probables!

"The next morning we hit Haipong in Indo-China and wrecked two ferry boats with strafing and blew up the dock area. There was no air interception.

"Once more back in Kunming we added up our losses. One pilot, and two ships lost, two ships damaged (but they flew again). The Japs had lost between 40 and 50 in the air and I don't know how many on the ground and in bombed and sunk freighters.

"In those six days I had flown 37 hours in combat, had shot down two to four enemy aircraft, and probably destroyed others. Just as an example of what one man can do, a pilot from the Blank unit shot down three confirmed over Canton in one flight!"

The Blank Pursuit Group rolled right along, led by their tireless young colonel. On Christmas Scott went aloft looking for prey but found no Jap air activity. On the following day he shot down two Jap fighters in honor of the birthday anniversary of the late Capt. Don Brown, USAAF, son of Joe E. Brown the actor. When the comedian heard of this tribute by Scott, tears came to his eyes as he declared, "That is a wonderful gesture. I wish we had more men like Scotty in our Air Force."

Up to the first of January this pursuit group had unleashed its power on the luckless Jap at many strategic points; Yunnan, Kwansi, Hunan, Fukien and Kwangtung are littered with the wrecks of Japanese aircraft shot down by these American air devils. Their probables will never be known, but they run in the hundreds.

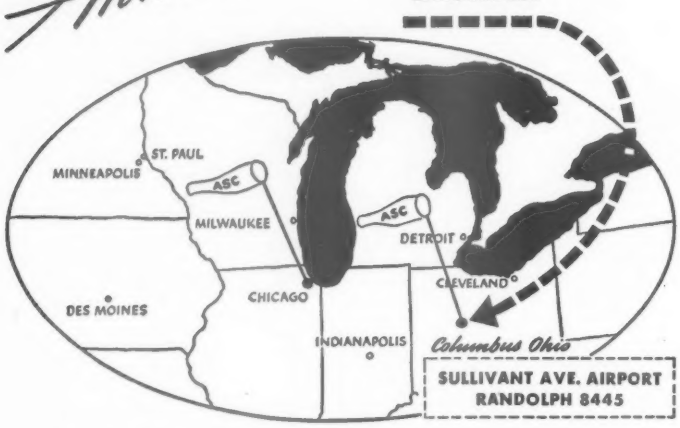
Scott's incessant plea is for 500 American pursuit ships for the skies of China. They would clean the Japanese out of the country, he says, and do it in short order.

He should know!

END

SNYDER AIRCRAFT CORPORATION

Announces! NEW SALES BRANCH



For speedier service to our eastern customers we have opened a branch at the Sullivant Avenue Airport in Columbus, Ohio, with a complete stock of parts, accessories and supplies. If it's more convenient, send your order to Snyder Aircraft Corp., Sullivant Avenue Airport, Columbus, Ohio, or call them at Randolph 8445, Columbus, Ohio.

Same quick service—high quality—and guarantee that has made Snyder Aircraft Corporation one of the leading Aircraft Supply Companies in the midwest. All service work, motor, instrument and accessory overhaul will continue to be handled by our staff of expert technicians at our Municipal Airport shops in Chicago.

SNYDER AIRCRAFT
MUNICIPAL AIRPORT CORPORATION CHICAGO ILLINOIS

APPROVED REPAIR STATION NO. 294

5 YEARS AGO

FROM the June, 1928, issue of this magazine:

Planned to start on June 30 were the National Air Tour, James Gordon Bennett International Balloon Race and the National Model Airplane Contest—all at Ford's Dearborn, Mich., airport . . . Wings of the plane used by Baron Gunther von Huenefeld, Capt. Herman Koehl and Comm. James C. Fitzmaurice in their Dublin-to-Straits of Belle Isle flight were coated with paraffin to prevent ice forming . . . An airport beacon was erected by the Tempe, Ariz., Civic Club, marking the first in a series of developments opening Arizona to night flying.

* * *

"Where are the lightplane clubs?" asked Earle Ovington, the first airmail pilot. In a story he answered the question with, "there are no American lightplanes" . . . Neither biplane nor monoplane has proven itself definitely and generally superior to the other, said Edward P. Warner, Assistant Secretary of the Navy for Aeronautics . . . George E. Johnson, a building contractor, said he found flying around the country on business trips far cheaper than driving a car.

* * *

"Germany is the only country in direct competition with American airplane manufacturers in the South American field," wrote Michael A. Zuniga, vice-counsel of Belgium, prior to a take-off on a South American good-will jaunt . . . A tribute was paid to Floyd Bennett, who had died of pneumonia in April.

END

Hats Off to Stinson

BAD NEWS FOR HITLER

Thumbs up, STINSON, for the universal enthusiasm that is greeting your trusty "Sentinel." It is bringing good news to our fighting men throughout the world . . . the kind of bad news we like our ruthless enemies to hear.

Thanks, STINSON, for the confidence you have placed in the engineers and craftsmen of Grand Rapids Industries who produced so many of the wing and tail surfaces for your "Sentinel." They are among the parts for thousands of Army planes and giant gliders coming from our plants in the Furniture Capital of America.

To other Airplane Manufacturers: All of our facilities and experience are "at your service" — engineering, research, and production from hundreds of fast, modern woodworking machines, the volume capacity of a total of over 2½ million feet of productive floor space — to help in building America's invincible air power.

GRAND RAPIDS INDUSTRIES, Inc.

MONUMENT SQUARE BUILDING · GRAND RAPIDS, MICHIGAN

15 Plants Famous for Fine Furniture
United in Production for the Aircraft Industry

WHO'S WHO in Aviation

The Only Book of its Kind

A BIOGRAPHICAL ROSTER OF OVER 4,000 NAMES
Associated with Aviation's Dominant Role in Modern Life

486 PAGES *of Living, Vital Information*

Now, for the first ti[me] ...-to-use volume, complete biographical infor[mation] ...out the most distinguished personalities in Am[erican] ...n. Over two years of specialized research has ...ive coverage of all branches of aviation.

IT ...ese Important Facts

● Name ... address. ● ...e and place of birth; names ... ● Pilot Record: where learned to fly; certifi... pilot; aircraft ...ase; number of logged hou... Aviation Busines... Record: complete with po... and places of employment. ● Military R... dates. ● Clubs and Memberships: ... honorary ...cieties. ● Contributor: ... date of publication.

...ese Important People

... PERSONNEL. Army . . . Navy . . . ... Officials of the Civil Aeronautics Board. ... aviation. ● ...ey men of commercial airlines. ... executives. ● Outstanding pioneers in avia... ...al technicians and scientists. ● Prominent

Invaluable to You

... of aviation to ev... ...cr... ... data that ... ...co... ...on ... ...the fi... of ... ...truc...

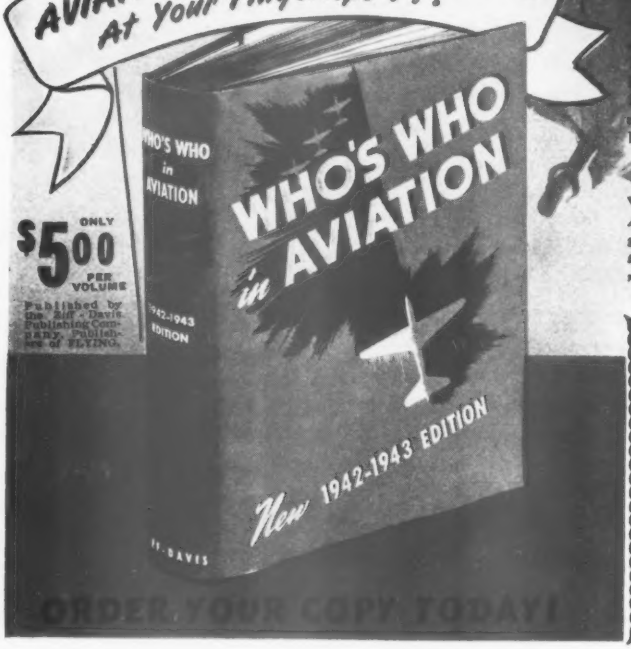
...s Leaders

... ...complete ...OL. ROSCOE ...

...haustive and ... ...
...Glenn L. Marti... ...
...me ... complete in ... ...ge.
Vice ...ident, United ...

FREE EX...ION OFFER

Verify, for yourself, ...obligation ... *Who's Who in Aviation* will have ... We will send you ... guarantee that if you are not entirely satisfied ... ...tics of aeronautics ... you may return it within ... and your money will be refunded in full.


AVIATION'S VITAL STATISTICS
At Your Fingertips . . .
WHO'S WHO in AVIATION
1942-1943 EDITION
New 1942-1943 EDITION
ONLY $5.00 PER VOLUME
Published by the Ziff-Davis Publishing Company Publishers of FLYING
ORDER YOUR COPY TODAY!

TO SECURE YOUR COPY, FILL IN AND MAIL COUPON

Ziff-Davis Publishing Company
Book Division, Dept. 643
540 North Michigan Avenue
Chicago, Illinois

SPECIAL 10-DAY EXAMINATION COUPON

Please send me.....copies of WHO'S WHO IN AVIATION, New 1942-43 Edition, at $5.00 per volume, on the understanding that if I am not fully satisfied, I may return them for full refund. I enclose $..... in ☐ check or ☐ money order.

Name .....
(PLEASE PRINT PLAINLY)

Address .....

City.....*State*.....

(On all orders outside of U. S. A. add 25c for packing and handling)

Pin-Point Blasters!
The fire-power of our new Navy is not measured in terms of tonnage or turrets alone. Every big gun afloat is backed aloft by a potent dive-bomber capable of blasting the enemy with pin-point accuracy. Such long range extension of fire-power stems from Navy pioneering of 24 years ago. Its effectiveness confirms the strategy of its originators.
BREWSTER Blasters
BUCCANEER AND BERMUDA DIVE BOMBERS
NAVY F3A FIGHTERS

'Patter'

(*Continued from page* 80)

students under a more skillful and patient instructor.

Other recordings indicated that pilots were teaching flying, but they were *not teaching students.* Ironically enough they were saying very little to their apt students, who needed comparatively little coaching, whereas they were dishing out a stream of chiding to the slower, dumber ones. And the slower students were the very ones who should have had good, calm, letter-perfect instruction.

Of course no amount of analysis, like the "Patter" books, will overcome sheer 'atigue. Pilots who are nervous from hour after hour of instruction simply can't help jumping, so don't sit back in your warm and comfortable chair as you read this and condemn the poor instructor who had to take near-crashes as a daily diet. If you have never sat in an airplane with a student making simple, silly, idiotic mistakes . . . if you have never avoided collisions by the dozen . . . if you have never been dived into the ground or landed at 50-foot altitudes . . . you have no right to condemn. If you haven't done your instructing in an open cockpit, in almost zero weather, you should think twice before sounding off. Finally if you have never done it for hour after hour, all day long, six, and seven days a week, year after year . . . well, you'll agree that there's a reason why instructors lose patience and become irritable when Dilbert forgets to crack his throttle as he circles the field.

Be that as it may, the country needed pilots and needed them badly. If they were to be trained in larger numbers with the existing planes and pilots, and if they were to be trained *better* than before, something was needed that would help lower washouts, improve instruction, and inject a new spirit into the students' flying careers.

First of all there were hundreds of recordings made of actual flight instructions—most of them indicating that there were more faults in instructors' ways of presentation than we ever imagined. Back in the '30's anyone who could fly for 200 hours and get a license was called a "flight instructor," and in the Navy anyone who had been with the Fleet for several years was considered competent to instruct. Out of this ridiculous situation arose the concept that a flight instructor must be someone who could impart the knowledge of how to fly—someone who understood that teaching was a matter of presentation and repetition.

From the recordings it became clear that most instructors were so hazy about their own manner of doing maneuvers that they could not explain them! Or else, if they knew what they were doing, they could not put their idea into words. Or, perhaps they put it into words, but in such a jargon of colloquial aviation lingo that no green student could understand the vocabulary they used.

It seemed evident that some adequate texts or aids to teaching were needed—some books, perhaps, that would help not only the instructor but the student. Accordingly two years of hard work were spent in writing and re-writing a book called "Patter" and one called "Fundamentals of Primary Flight Maneuvers." They were put into use by various flight instructors, who suddenly became aware that their teaching job was easier! And the students who used the book on fundamentals observed that their group knew more at 25 hours of instruction than other groups did after 35 hours.

An idea that good was too valuable to pass up, and in 1942 the Navy commenced work on the revision of the "Flight Maneuver" and "Patter" books so that the contents would coincide with Navy maneuvers. An aviator was assigned to help in the writing of all maneuvers, the revision taken to the Pensacola Naval Air Station. When all had been approved, 40,000 copies were printed for distribution to each Navy Training Center. Also, WTS schools (formerly CPT) that trained Naval cadets received free copies.

Here is how the maneuver sheets work. Before going up for a hop, an instructor hands his student a page or two from the loose-leaf booklet, instructing him to study them carefully. On these sheets is a carefully worded, concise explanation of the particular maneuvers to be flown; be they turns, glides, landings, or take-offs.

Of course, you might object that all of us have used that method, in that we've given a book on flying to our students. Yes, perhaps we have, but have the boys studied it, or have they skimmed through it—reading those chapters that were most interesting? More than likely, it is the latter.

Furthermore, no student is taken aloft unless he can answer pertinent questions about the maneuver sheet: What is a steep turn? What controls are used? When do they cross? (Or similar questions. It is explained fully, in the maneuver sheets, that controls do *not* cross!)

The comical part of it all was that it forced flight instructors to standardize their teaching! Instructors could no longer decide to do it their way because the students would want to know "why." On the other hand instructors were able to take some of the teaching for granted, and a long, tedious explanation could be omitted. Instead, a few judicious questions would tell the instructor whether or not the pupil had read the lesson and if he understood it.

That led in turn to the second book, called "Patter." If the maneuver sheets standardized the actual maneuvers, there might be a chance to standardize the talk, or Patter, used by instructors. *Patter,* as defined by Webster, is not exactly

(*Continued on page* 146)

Vultee Aircraft Selects Hallicrafters Equipment for Radio Flight Recorder

The ultra-sensitive ground-unit "brain" of Vultee Aircraft's new radio recorder is monitored by a Hallicrafters shortwave radio communications receiver. This test-flight unit, originated by Vultee engineers, gives multiple instrument readings flashed in split-second cycles through a Hallicrafters communications receiver to ground crew tabulators during actual test flights.

Your post-war Hallicrafters communications receiver will be worth waiting for.

hallicrafters
CHICAGO, U. S. A.
The World's Largest Exclusive Manufacturer of Short Wave Radio Communications Equipment

Hallicrafters communications receiver (illustrated) Model SX-25—12 tubes, 4 bands. Frequency range of 550 kc. to 42 mc.

OLDTIME CRAFTSMANSHIP

Engineered Into the Products of Today . . . and the Future

Time was when workmen loved to refine and polish their work to a high degree—for the pleasure it gave them. Their hearts were in it.

These craftsmen of old could not even imagine the functional soundness and extreme accuracy which we are building into Dole Aircraft Valves and Fittings. Nevertheless some of their craftsman attitude goes into this highly modern product.

When our customers—among the Aircraft Industry's leaders—have time to comment, they tell us "Dole quality is unsurpased." That's a way of saying our hearts—and heads—are in our work.

Against the day when you will need engineering services to assist both in the design and production of precision valves, fittings and accessories, remember us.

Made In Accordance With Army-Navy Aeronautical Standards.

THE DOLE VALVE COMPANY

ESTABLISHED 1906

1901-1941 Carroll Avenue, Chicago, Illinois

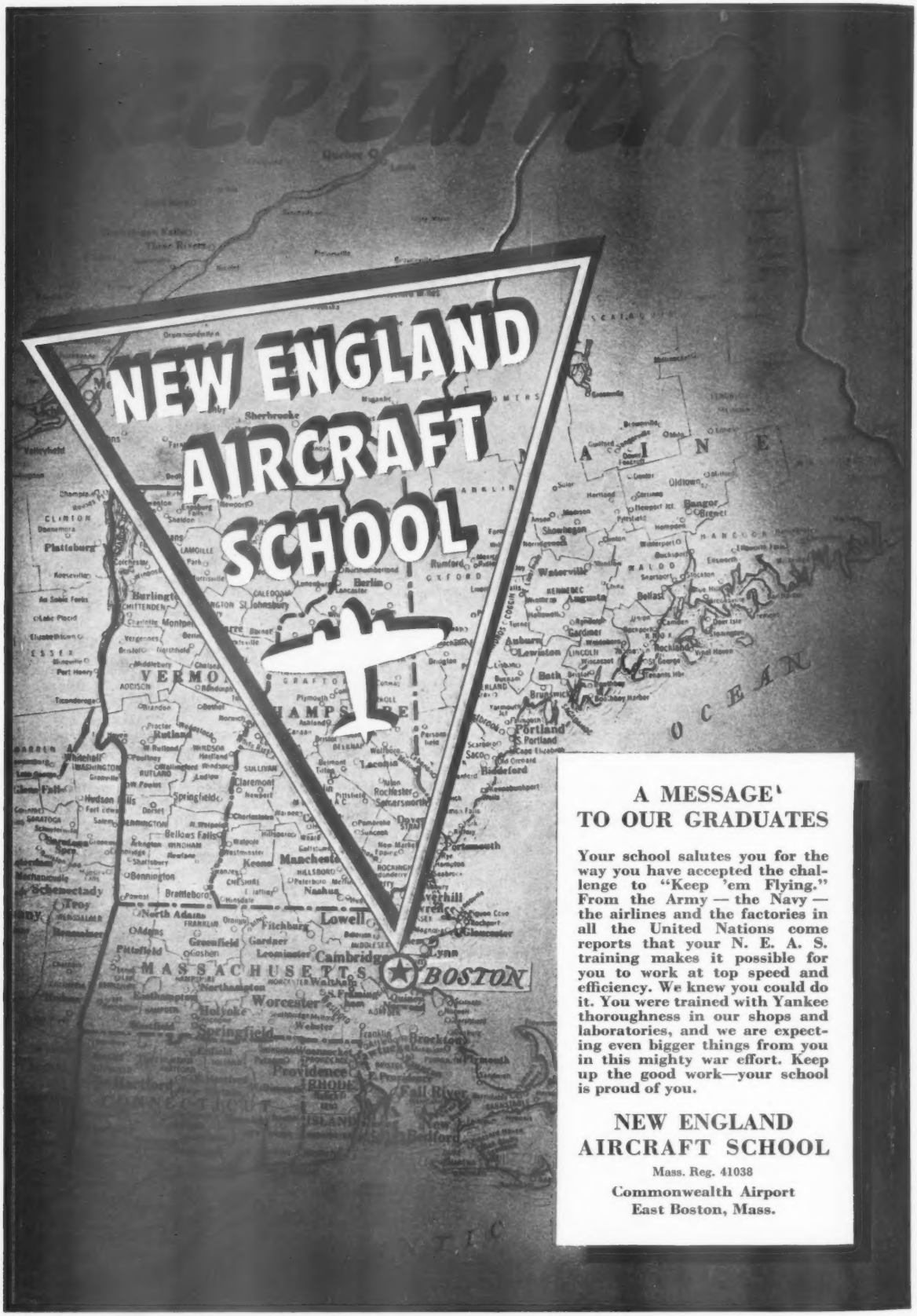
LOS ANGELES • DETROIT • PHILADELPHIA

★

BUY U. S. WAR BONDS AND STAMPS

DOLE

AIRCRAFT VALVES AND FITTINGS



A MESSAGE TO OUR GRADUATES

Your school salutes you for the way you have accepted the challenge to "Keep 'em Flying." From the Army — the Navy — the airlines and the factories in all the United Nations come reports that your N. E. A. S. training makes it possible for you to work at top speed and efficiency. We knew you could do it. You were trained with Yankee thoroughness in our shops and laboratories, and we are expecting even bigger things from you in this mighty war effort. Keep up the good work—your school is proud of you.

NEW ENGLAND AIRCRAFT SCHOOL

Mass. Reg. 41038

Commonwealth Airport
East Boston, Mass.

EQUIPMENT SUPPLIED BY WEEMS SYSTEM OF NAVIGATION

1. WSN Speed-Time-Distance Calculator.
2. Navigation Note Book & Plotter, *Weems.*
3. Aircraft Plotter, Mark II.
4. Simplified Celestial Navigation, *Weems and Link.*
5. Air Navigation Outline, *Keator.*
6. Line of Position Book, *Weems.*
7. Illyne Star Chart, with booklet.
8. Air Almanac, for 4 months.
9. Radius of Action of Aircraft. *Tornich.*
10. Marine Sextant.
11. Second-Setting Watch.
12. Marine Navigation, *Weems.*
13. Link Averaging Bubble Sextant.
14. Instrument Flying, *Weems and Zweng.*
15. WSN Course and Distance Protractor.
16. Air Navigation, *Weems.*
17. Star Altitude Curves, *Weems,* per 10° Lat. Band.

Write to: Weems System of Navigation, Annapolis, Maryland

(*Continued from page* 142)

complimentary to instructors: ". . . a kind of rapid, voluble speech or harangue such as is used by fakers or tricksters . . ." But in spite of that derogatory definition, the word now is used to refer in aviation to the talk that goes along with an aerial demonstration of maneuvers.

The book called "Patter" was a simple, little blue manual small enough to fit into a pocket. Some instructors take a copy into the air with them so they could check themselves or refresh their memories. It was handy, compact, and contained the essential elements of the maneuvers—written in easy, simple language and in a standard vocabulary. That was half the battle—to get all the instructors to describe their maneuvers the same way, in similar words, and with the accent on all the main points instead of just one or two.

Of course, neither "Patter" nor the "Flight Maneuvers" were a cure-all for the ails and troubles of over-worked instructors. They were still tired, but they didn't have to work as hard to get out a standard student. Take a look at a sample page of *Patter* and see for yourself:

LEVEL FLIGHT

Keep your toes resting lightly on the rudder pedals and hold the stick with the thumb and one or two fingers of your right hand. In that way, you can get the feeling of the plane. Later, you'll learn a firmer grip. Keep your left hand on the throttle so you can move it with a wrist motion.

Now I'll explain the position of the plane while it is in level flight at cruising speed. When the plane is in flight, the control surfaces tend to streamline themselves with the plane. The attitude of the plane is controlled at all times by pressure on the stick and rudder. The proper movement of the controls should be slow and smooth, yet positive.

Now look at the nose . . . notice where it is in relation to the horizon. That's where it is when the plane is flying level at cruising speed. When the nose is higher than that, the plane is climbing. When it's lower, the plane is either gliding or in a dive. Now look at the right wing, etc.

Easy and clear—simple and sound. Just as if the instructor were telling a student what to do and how to do it. But the "Patter" was vitally necessary because 75 per cent of all instructors varied their instruction or didn't give instruction at all. Remember, instruction consists of presentation and repetition, and some instructors didn't even know how to present their material, much less repeat it.

That's what "Patter" was intended to do—to help the non-talkers to explain, and to guide those who did too much random talking. But in order to sell the instructors on the idea of using "Patter," here is how it was introduced:

TO THE FLIGHT INSTRUCTOR

In this booklet you will find appropriate patter to accompany each of the flight maneuvers taught in Stages A and B of primary training. At first glance, you'll probably say, "Sure, that's o.k., but that's just the way I explain it."

The primary reason for the development of this patter was the discovery that instructors vary greatly among themselves with regard to the fullness of explanation, the variety of terms used and even in the accuracy of their explanations of maneuvers. For example, one analysis of the recordings of four different flight instructors for the pre-solo dual instruction of four different students showed that a total of 500 different technical words and phrases were used; of the 500 different terms only 70 were used by all four instructors, while 265 were expressions used by only one of the four. In other words, each instructor had his own favorite words and phrases, which the others never used.

Students have a hard enough time learning to fly without trying to figure out each instructor's private vocabulary. In these days, especially when instruction must be made as efficient as possible, it seems wise to make explanations, particularly those used in primary instruction, simple, complete and straight-forward. It was with this goal in mind that these sets of patter were prepared.

Of course no one was so sanguine as to hope that one hundred per cent of all Navy instructors would immediately begin using "Patter" and join in the parade of improved instructing. But the newcomers—the youngsters just out of training—are the ones who will eat up new methods. That is the rule the world over, whether it be young generals in a Nazi army or progressive men in air corps. Youth moves ahead.

But a final effort was made to put the idea across. A well-known artist with a humorous bent was induced to illustrate each page of "Patter" with a semi-humorous sketch. At the end of this article is a sketch which appears on page nine of "Patter," to accompany "Level Flight." It has a delicate point, which when found strikes most pilots as being darned funny, especially those who have been caught in the same predicament.

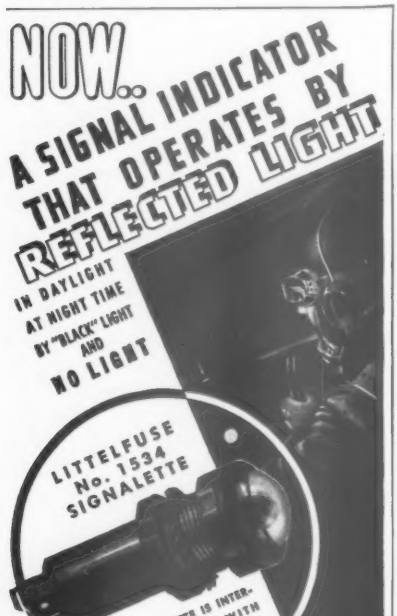
Here it is . . . look it over . . . and then decide if you would have been sold on the idea that "Patter" was worth the time and effort, after all!

END

Study Future

TODAY America is turning out thousands of pilots, planes and aerial accessories, factories are operating at limits never before even dreamed possible. With the war came an expansion in the air field which might face retrenchment when the war is over. For this reason, and to try and put off or entirely eliminate the disintegration of the immense air program of today, Oliver L. Parks, president of Parks Air College, recently called together four aeronautical associates.

The men—Walter Thrope of the Alabama Aeronautics Institute, Frank Struif of the Mississippi Aeronautics Institute, Fulton Moore of the Cape Institute of Aeronautics and Fred C. Parks of Parks Air College—decided to make a comprehensive survey of the entire field of aviation. The ultimate objective of the survey is to plan and finally initiate one or more constructive projects in post war aviation which will provide useful and profitable employment for Parks personnel and perhaps the entire industry.


NOW...
A SIGNAL INDICATOR THAT OPERATES BY REFLECTED LIGHT
IN DAYLIGHT
AT NIGHT TIME BY "BLACK" LIGHT AND
NO LIGHT
LITTELFUSE No. 1534 SIGNALETTE
SIGNALETTE IS INTERCHANGEABLE WITH LAMP ASSEMBLY AC 4283593

LITTELFUSE Signalette

Indicates by reflected light, visible light, "black light" and by fluorescent-radio-active luminescence. Operates by solenoid. When activated, "butterfly" opens instantly showing signal. No blur, no dimming. Non-shatterable protection. Plastic cap withstands severest tests. No burn-outs as with lamps; no delicate parts to break from shock or shell explosion; no spare lamps required. Uses about ½ current of filament lamps.

Wire or write for Signalette Bulletin. Ask about samples for test.

LITTELFUSE
INCORPORATED

4793 Ravenswood Ave., Chicago, Illinois
263 Ong St., El Monte (Los Angeles suburb), Calif.

EVERY ALERT AMERICAN URGENTLY NEEDS THIS COMPLETE 384-PAGE

Aircraft Spotters' Handbook

BRAND NEW! Contains *2-Line* FLASH IDENTIFICATION of 350 Foremost Bombers, Fighters and Other Military Aircraft of Warring Nations! Over 1,300 Photos and 3-Position Silhouettes! Combines 4 Famous Best-Selling Spotters' Guides, PLUS NEW Material, in One Big Book!

THIS NEW COMPLETE HANDBOOK includes hundreds more fighting aircraft than any other similar manual. It is beyond comparison the biggest, finest, most comprehensive and up-to-the-minute Aircraft Spotters' Handbook available anywhere in America. It contains over 1300 photographs and silhouettes, with the amazing new 2-line FLASH IDENTIFICATION feature—practically a course in aircraft-spotting! Helps you to distinguish friendly and enemy planes at a glance!

No less than 350 military aircraft are described and illustrated, including nearly 100 American warplanes, over 50 British, 50 German, 35 Jap, 30 Italian, as well as planes of Russia, The Netherlands, Norway, Spain and France. Includes also Barrage Balloons, Blimps, Gliders, and Rotating Wing Aircraft.

You are shown authoritative photographs of all these aircraft, and given specifications, markings and physical characteristics to aid you in positive identification. Silhouette views show each plane from three angles so that you can identify a plane or group of planes simply by the outlines! Another interesting feature is the explanation of how planes get their designations, and such names as Helldivers, Spitfires, Zeros, etc.

You'll be able to identify all the famous planes you read about in the news dispatches from Africa, France, Britain, Russia, China, Burma, the East Indies, the South Pacific, and Alaska—American Flying Fortresses, Hudsons, and Airacobras; British Hurricanes and Spitfires; Russian Stormaviks and Moscas; German Stukas and Messerschmitts; Jap Zeros; and hundreds more! Edited by L. C. Guthman, Ensign, U. S. Naval Reserve.

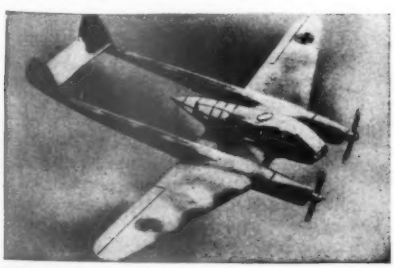
only $1.00 with thumb notch index

Size 5⅛ by 7"

AN authoritative, up-to-date guide for civilian defense workers and everyone interested in aviation, whether as a hobby or a study. Perhaps you like to build model planes. Perhaps you are looking forward to the coming opportunities in the airplane industry, as a mechanic, flyer, maintenance man. Perhaps you are now employed in aircraft production, or want to qualify for military aviation—this Guide will provide you with much up-to-date and useful information.

Flexible Covers—Rounded Corners

Sturdy, flexible, water-repellent binding patterned on lines similar to the official U.S. Army Drill Manuals. THUMB INDEXING makes it a matter of an instant to turn to any of the 12 major types of military aircraft into which the book is divided. In contents, arrangement and format it is the most thoroughly practical book that could be devised—one that will give the maximum of service and quick information. Quantity limited. Rush your order on attached coupon. National Aeronautics Council, Inc., 37 West 47th St., New York, N. Y. (Copyright, 1943, by National Aeronautics Council, Inc.)

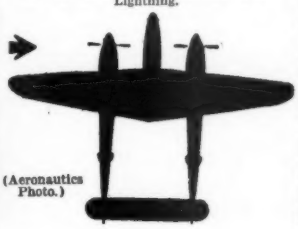


FRIEND OR FOE?

(Airpix, Toronto.)

The 2-line FLASH IDENTIFICATION identifies this plane instantly as the GERMAN Focke - Wulf FW 189.

The 2-line FLASH IDENTIFICATION identifies this plane instantly as the AMERICAN Lockheed P-38 Lightning.



(Aeronautics Photo.)

MAIL THIS COUPON TODAY!

NATIONAL AERONAUTICS COUNCIL, Inc., Dept. 286
37 West 47th Street, New York, N. Y.

YES, for the enclosed $1, please rush me POSTPAID, for a week's FREE examination, the big 384-page AIRCRAFT SPOTTERS' HANDBOOK, in flexible binding with rounded corners and THUMB INDEXING. Over 1,300 photographs and 3-position silhouettes, descriptions and amazing exclusive 2-Line FLASH IDENTIFICATION of 350 warplanes and other military aircraft of the world's warring nations. After 7 days, if not more than delighted, I may return the book and you will immediately refund my full $1—making the trial absolutely FREE!

Name .....

Address .....

City & State.....

☐ I also enclose $..... for ..... copies for friends, on same terms.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA) with National Service Office located in the Carpenters Bldg., Washington, and Registrar's Office in the Michigan Square Bldg., Chicago, is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special Bulletin is sent each month to all registered AOPA pilots and also confidential memorandums from AOPA's Washington staff are sent members from time to time.

Confusion at Its Best

WE would not attempt to give an "Oscar" to the most confusing (or confused) Washington agency, for this is a question of no mean proportions. We venture to say that a safe bet "to show" would be on the CAA's six-foot bookshelf, known as the CAR or Civil Air Regulations, which has now become so voluminous in size and contradictory in content that some of the nation's best lawyers can't agree on the intent or purpose of many sections.

Yet civil and military pilots—ordinary individuals like you and me—are expected to conduct their flight activities in such a manner as to avoid violating the sacred covenants of the CAR. The answer is obvious. Pilots do not comply because they do not know *how* to comply.

What Is Wrong?

The whole concept of the CAR seems to be premised on passing a regulation for every conceivable *possibility* rather than to limit its scope to a few main essentials. Thus, in place of having 10 or 20 simple "rules of the air," we have a conglomerated mess of legally phrased soup divided up into parts, sections, paragraphs and subparagraphs (not to mention voluminous footnotes).

An attempt has been made recently to boil these down by showing diagrams, but unaltered is the continued practice of pyramiding more regulations on top of the present conglomeration. It is readily admitted by those whose jobs call for drafting these additions that the setup has been so complex that every new addition usually requires innumerable "amendments" to other sections (parts, paragraphs, or subparagraphs)!

Simplicity Only Solution

Rather than to wrangle forevermore with each new regulatory brain storm, AOPA would like to formulate (with the assistance of its members) a group of rules to cover flight of aircraft which, written in layman's language, are normally essential, reasonable and, equally as important, enforceable.

After similar experiences in complicated regulations (which no one could understand much less abide by) automobile traffic regulation has finally settled down into a few simple rules of the road, such as "do not pass on the crest of a hill, stay in the extreme right lane except when passing," etc. Many states have even relaxed speed regulations (overlooking for the moment the wartime limit of 35 m.p.h.), instituting in lieu thereof one simple regulation: "Do not drive recklessly."

Each AOPA pilot can assist tremendously by forwarding his suggestions on such a draft of rules. From these a summary will be compiled and circulated to the membership for further redrafting. From this process AOPA hopes to evolve a set of rules for adoption on a national scale to replace the present typesetter's dream. Write your suggestions to the AOPA National Service Office, Carpenters Building, Washington, D. C.

W. L. Stoddard and his flying son, David. The 10-year-old lad has had 20 hours dual.

Like Father Like Son

AOPA member **W. L. Stoddard** (AOPA 2107), a proficient pilot-member himself, has an even more remarkable son, according to recent reports reaching the AOPA Washington office. Father and son are both shown in the accompanying photograph and here is the interesting story in connection with it.

W. L. Stoddard, who incidentally was a charter AOPA pilot, is now flying at an Army primary contract school as special instructor in charge of all weak students or "wash-backs." Besides this, he operates a municipal airport, trains private students and gives refresher courses for future Army instructors. He holds an A and E license and supervises the maintenance of all privately owned aircraft at that field.

Son **David**, who was 10 years old February 12, has had about 20 hours' dual time in a Piper *Cub*, during which time he has accomplished landings and takeoffs, lazy eights, and does a good job at any maneuver that is demonstrated to him. Special rudder pedals have been arranged to permit him to fly comfortably. Proud father says: "His general technique can be conservatively rated equal to the average pilot when he receives his private certificate." In fact, Stoddard is so enthused he is endeavoring to see if a special waiver cannot be arranged so that the boy may make one solo flight. If so, says Stoddard, AOPA will have its youngest pilot-member.

This should be ample testimony for some of the oldsters who hold back and shy away from flying, believing that it takes some form of superhuman skill.

"Cockpit Clatter"

Recently another confidential bulletin, *Cockpit Clatter*, was mailed out direct to all registered AOPA pilots. Here are some odds and ends which may be of interest to many pilots at large:

WPB order L-262 (which may be modified or changed before this hits the press), the most widely debated regulation concerning non-scheduled flying because of its ambiguous language, has caused many hardships and great confusion. As a result of a meeting called by **Sen. Pat McCarran** of Nevada between CAA and WPB, a number of ships have been released for operators to continue student training for "pay students" (non-Government contract training). Look for sudden and additional changes.

CAP pilots report to AOPA that many ships on active patrol duty are in need of aircraft parts and repairs. CAP headquarters, on the other hand, advise that the situation is not alarming; that they are able to obtain adequate parts. We hope the latter is the case.

AOPA Pilot has been selected as the new name for the pictorial news bulletin sent to AOPA pilots each month. While in the process of name changing from the old *AOPA Section* we temporarily hit upon the name *Membership Bulletin* which is used for the last time in this issue.

"Lost" Squadron

Four pilots are reported "lost" by AOPA's Registrar in the Chicago office (Michigan Square Bldg., Chicago, Ill.). Anyone knowing the present whereabouts of these AOPA pilots should transmit their names and new addresses immediately to the foregoing address so that regular AOPA services may be continued to these persons.

Jacob Molinoff, AOPA 8751.
Gordon C. Munro, AOPA 8455.
Robin E. Sheppard, AOPA 8159.
Lois E. Stewart, AOPA 8207.

Experts at your elbow!

Here is the book aircraft workers and students have been waiting for — all the data, charts, tables and odd information on every phase of airplane building in a pocket-size, loose-leaf book.

If you check fluid lines in assembly, the AIRCRAFT DATA BOOK gives you a quick-reference chart of standard color identifications — fuel lines red, water coolant lines brown, and all the others right down the page.

If you are an engineer, a chart on tensile strength of materials, plus many other technical tables and formulae makes the DATA BOOK a handy reference library for you.

A Dictionary of Aircraft Shop Terms, included in these practical pages, are a boon to the beginner, refresh the experienced on forgotten nomenclature. No institution in the country is better fitted to produce such a reference book, for Aero Tech's sole business for years has been the teaching of aircraft mechanics and design. Thousands of young men, now in the industry, started their careers in this school. Aero Tech's faculty represents one of the greatest stores of aircraft knowledge ever accumulated by one organization.

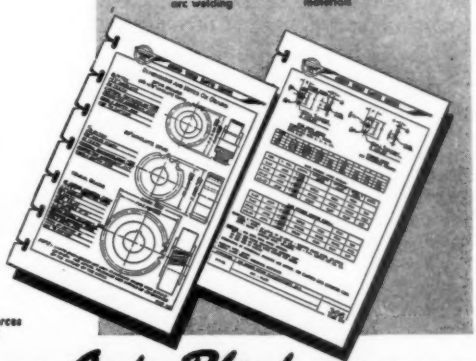
Manufacturers and individual authorities were consulted and their special knowledge and advice incorporated in the Data Book. Edited by Thomas M. Shelton, Director of Education at Aero Industries Technical Institute, this is a dependable, handy reservoir of aircraft information for all those in the industry. It may well be considered an additional tool for modern aircraft construction.

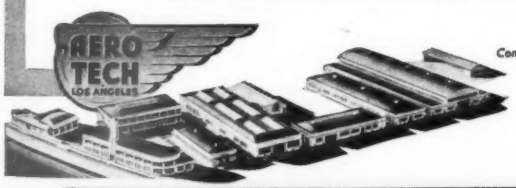
A washable cover makes the DATA BOOK practical for shop reference. With the new, patented loose-leaf binding, pages can be lifted or inserted with a flip of the fingers, without metal clasps to open or close.

Ask at your plant library for Aero Tech's AIRCRAFT DATA BOOK. If you want a copy of your own for at-your-elbow authentic consultation, ask for it at your factory store or fill out the coupon below or send, with check or money-order, direct to Aero Tech. Your copy will be sent postpaid at once.

Here are a few of the charts, tables and other information in your Data Book:

- Dimensions and notes on gears
- Fits and tolerances
- Drill and ream notes
- Complete Air Corps Standard Sheets
- Plating formulae
- Production breakdown of typical airplane
- Weights of bar steels
- Insulated wire sizes
- Surface cutting speeds for automatic screw machines
- Welding torch tip and drill sizes
- Rod size current volt table
- Rod motion pattern—arc welding
- Set back chart for bending
- Directory of protective coatings
- Standard colors for fluid line identification
- Dictionary of aircraft shop terms
- Weight conversion charts
- Steel type and numbering chart
- Rivet code
- Threads tables
- Standard gauges chart
- Tensile strength of materials





Contractor to U. S. Army Air Forces Technical Training Command

AERO INDUSTRIES TECHNICAL INSTITUTE

5255 West San Fernando Road
Los Angeles, California

Order Blank

AERO INDUSTRIES TECHNICAL INSTITUTE
5255 W. San Fernando Road, Los Angeles, California

Gentlemen: Enclosed find $1.50 (check, money-order) for my copy of AIRCRAFT DATA BOOK, sent to me postpaid.

Name_____

Street address_____

City_____ State_____

A-60-PA

Letters

Gallon Per Hour

Sirs:

"If that item in Paul Pierce's 'Constellation' article [FLYING, March, 1943] is true, it should be a military secret. Note the statement saying 'its four great engines drink only *one* gallon of gas per hour' . . . If that is true, I want one for my car; I only have an 'A' card."

DEAN E. AREHART

Sirs:

"Is that statement about the Lockheed *Constellation* using only one gallon of gas per hour true or a misprint?"

SGT. H. R. BRIGHR

Ft. Monmouth, N. J.

Sirs:

"I was amazed at some of the performance data of the Lockheed *Constellation* but there is one point which seems to be a misprint. I quote, 'At about half power, cruising at 100 miles per hour faster than today's airliners, its four great engines drink only one gallon of gas per hour. . . .' I am now flying a single-engine North American SNJ-4 with a 550 h.p. radial and a gas consumption of approximately 35 gallons per hour. What amazes me is that a small engine consumes 35 times that of four 2,000 h.p. engines."

C. C. CAVANAUGH
Ensign, USNR

Kingsville, Tex.

● Readers who picked up this typographical error are entitled to an explanation. The gas consumption is one gallon per mile, not per hour. If the former was true the plane could cross the United States on less gas than is used in a couple hundred miles of driving in a light car.—ED.

Civilian Instructor

Sirs:

The recent article ["The Civilian Instructor Comes Through," FLYING, March, 1943] was well written, but a final and lasting solution remains unrevealed. Being an Army primary instructor, I here move to add to that article and also offer a solution.

To the list of grief might be added income. Don't get me wrong, I feel well paid for my efforts after working in almost a jungle for eight months, lacking luxuries . . . saving every penny and then finding out that income taxes wipe out the complete account. I certainly am not improving myself financially.

Second is the matter of medical care. In this area, expert dental care is many miles away. No civilian hospital exists closer than 80 miles away.

Third, after this war is over flying for the Army will be over for us. We have no Army status whatsoever. When in town people mock us for being in "civvies" and we can't blame them. Even buck privates mock us with quips such as "How much are you paying your draft board?" or "Look, that's what I'm supposed to be fighting for . . ."

There is only one possible solution . . . and that is commission all instructors. Every gripe can be cured instantly by this move.

We wouldn't have to play officer in some near-officer-type uniform. We'd get proper medical and dental care. We would have a status where we could fly an Army airplane without seeing PT gremlins in our sleep. After this war is over, we could go back to "civvies" and retain a reserve commission and could keep up military flying.

It is true that we would like to get into the thick of things; it is a natural tendency for red-blooded Americans to want to be where there is action, but we have our compensation in the fact that it is possible for one of us to turn out 30 pilots a year, each somewhat a prototype of his instructor.

CHARLES F. HEPPLER,
Lake Byrd Lodge.

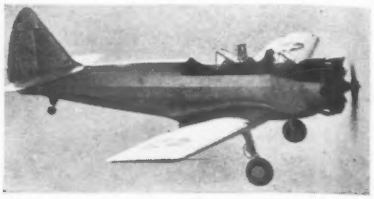
Avon Park, Fla.

● Like many thousands of unsung civilians who are doing vital war jobs, Reader Heppler rates neither a uniform nor medals. Notwithstanding the jibes of men in uniform, no one realizes the value of these civilians more than the Army and Navy. The 30 airmen Reader Heppler turns out each year are far greater and more lasting recognition of his work than any emblems, insignia or decorations.—ED.

Continental Vs. Warner

Sirs:

". . . We wish to call your attention to an error in the March issue. Aeronca



is building the PT-23AE, Army primary trainer, a Fairchild design, under subcontract [Photo above.—ED.]. However, the power plant in this ship is a 220 h.p. Continental motor—not a Warner [as stated in FLYING.—ED.]. The Aeronca-built PT-23 is referred to as the PT-23AE."

B. L. HINES
Aeronca Aircraft Corp.

Middletown, O.

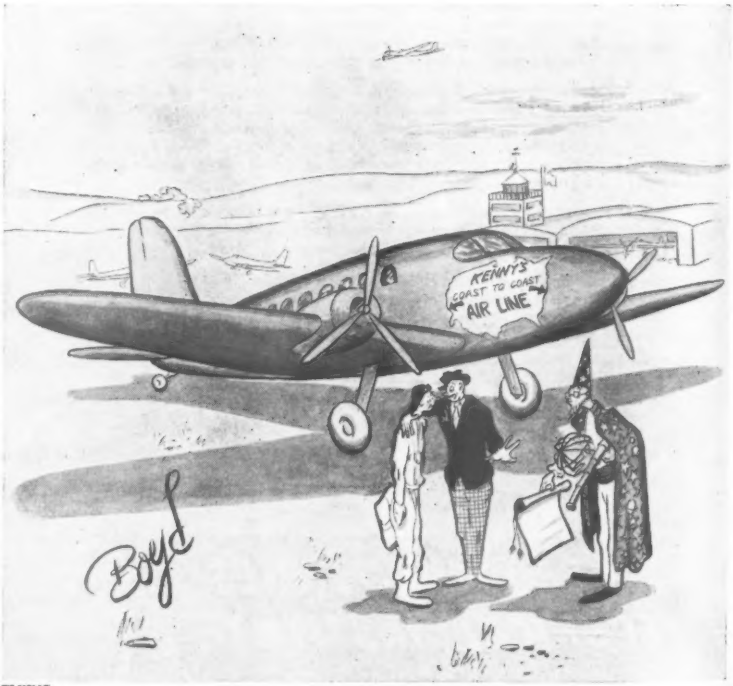
Recognition

Sirs:

The "For Identification" pictures published by . . . in FLYING . . . are certainly tops for the study of aircraft recognition. . . . Our note books are to be graded, and I'm sure I couldn't find better material for this than your pictures. . . .

SGT. E. SEMPLE
RCAF Flying Training School

Camp Borden, Ontario.



FLYING

"Your new navigator, Peters. They're hard to get these days."

PREPARE NOW with these New AVIATION BOOKS for Quicker Advancement

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

HOW OUR ARMY GREW WINGS—

Airmen and Aircraft Before 1914

By CHARLES deFOREST CHANDLER, *Late Colonel, U. S. Army, and* FRANK P. LAHM, *Brigadier General, U. S. Army, Retired.*

Chandler

Lahm

HERE is the real story of how our army grew wings by two of the men who saw much of it happen and themselves participated in the founding of what today is the mighty U. S. Army Air Forces. Covering the period from the Army's first use of observation balloons during the Civil War to the creation of the Aviation Section, Signal Corps in 1914, this is the authentic, interest-packed panorama of the era in which the "traditions of the service" took root.

NEW, COMPLETE, INTERESTING

It is the vivid and complete account of the facts and significant details of early flight and of the personalities—inventors, constructors, and pilots—who, in the face of infinite mechanical difficulties and often much prejudice, provided the foundation, and influenced the development of American military aeronautics.

CONTAINS A GREAT AMOUNT OF IMPORTANT REFERENCE DATA

This book is destined to become the established source of reference on this vital period in aeronautics. The authors, who knew and worked with so many of the men responsible for our early aeronautic progress, having recorded here the priceless personal knowledge and experience of these men, give us—after meticulous research for accuracy—an eye-witness account nowhere else available.

The adventures of pioneer pilots cannot be even remotely appreciated without knowledge of the craft on which they rode. Illustrations and descriptions of structural details are included for many of them.

370 Pp. 43 Illus. $3.75

Partial Contents

Early Aeronautics—Captive Balloons in Wars Before 1861.
Civil War Observation Balloons.
Events 1890 to 1906, Including Battle of San Juan Hill.
Influence of Ballooning as a Sport.
Army Aeronautics Is Revived—Genesis of Present Air Corps.
Langley Mechanical Flight Experiments—War Department Interested.
Aerostation at Fort Omaha.
First Army Dirigible Balloon—Signal Corps' Interest Aroused. The Baldwin Airship.
Birth of Aviation—Wright Brothers' Description of Their Experiments.
First Army Airplane—Specifications. Trials at Fort Myer. Augustus M. Herring.
Thomas E. Selfridge.
Army Flying in Texas: 1910-1911—Foulois Collier Machine.
College Park and Augusta, 1911-1912—Atwood's Flight to Washington. First 'Long' Cross-Country. Scott's Bomb Sight.
College Park, 1912—Proposed Legislation. Chandler Tests Machine Gun. Chandler's First Night Flight. Airplanes at Maneuvers. Hydro-Airplanes. Lincoln Beachey.
Aviation in the Philippine Islands.
Augusta and Texas City, 1913—Flying Pay First Authorized.
School at North Island, San Diego—The Curtiss School. Signal Corps Aviation School. Inventive Army Aviators. Ground School Prescribed. Parachute Demonstration.

AIRPLANE HYDRAULIC SYSTEMS

By HUGH C. AUMENT, Jr., *Instructor, Airplane Hydraulics, Roosevelt Aviation School, Roosevelt Field, N. Y.* Explains fully the operation of hydraulic equipment of airplanes so that anyone working with that system can understand it from A to Z, and understand both what to do and why he is doing it. Shows by easy-to-read text, simplified drawings and diagrams the construction of each hydraulic unit; its purpose; how it operates; the flow of fluids in the system and hydraulic operation; causes of troubles and how to correct them. Based on extensive experience in training men.

COVERS: Basic Hydraulic Principles and Fluids, Reservoirs. Check. Relief Valves. Hand. Power Pumps. Surge Chambers, Pressure Tanks, Accumulators, Selector Valves. Actuating Units. Pressure Regulator. Lines, Tubing, Seals, Glands. Comparison of Hydraulic Systems. Filters. Sperry Exactor Control. The Typical Systems. Inspection. 130 Pages, 76 Illus. $2.25

AIRCRAFT ELECTRICAL SYSTEMS

By WILLIAM F. JORCH, *Instructor in Aircraft Electrical Systems, Army Air Corps Training Detachment, Roosevelt Field, N. Y.* A practical servicing manual which gives you a thorough understanding of what the mechanic needs to know about aircraft electrical units, without having to go into complicated theories he doesn't have to use. Explains each component part of electrical systems; different types, purposes, construction and operation; simple, speedy methods of testing; and systematic procedure for quickly finding and eliminating causes of trouble. It is easy to understand, and by diagrams, questions, and charts helps the mechanic really get the what, why, and how of electrical system maintenance.

COVERS: Test Equipment and Instruments. Symbols. Generators. Generator Control Panels. Batteries. Starters. Ignition. Wiring. 223 Pages. 72 Illus. $3.00

AIR NAVIGATION

By E. R. HAMILTON. For those new to the subject who want to get a working knowledge in the shortest possible time. Requires nothing but common sense and the simplest mathematics. The user who reads the book carefully and works each of the many exercises will get all he needs to make a start in practical navigation. It is based on wide experience in teaching navigation in the Royal Navy and cadets of the British Air Services. Includes Position, Direction on the Earth; Maps, Charts, Plotting; Wind; Relative Motion; Astronavigation; Radionavigation. $2.00

1. MECHANICAL PHYSICS 2. SUB-ATOMIC PHYSICS

By HERBERT DINGLE, *Professor of Natural Philosophy, University of London.* A complete two-volume course in physics. Assuming only a knowledge of elementary mechanics and none of physics, these books give a clear account of fundamental ideas, results of research, in such manner that their application to aeronautics is readily understood. Comprehensive, concise, well adapted to both individual and class use.

VOL. I—Covers physics of matter, heat, and sound, where atom and molecule can be considered an elementary particle. $2.25

VOL. II—Deals with the structure of the atom, and with fundamentals of light, electricity, and magnetism, as well as X-rays and radio activity. $2.25

CHECK AND MAIL COUPON TODAY

THE RONALD PRESS COMPANY
Dept. M755
15 East 26th St., New York, N. Y.

Please send me the Aeronautics Books I have checked below—

- ☐ HOW OUR ARMY GREW WINGS, Chandler & Lahm..... $3.75
- ☐ AIRCRAFT ELECTRICAL SYSTEMS, Jorch..... 3.00
- ☐ AIR NAVIGATION, Hamilton..... 2.00
- ☐ AIRPLANE HYDRAULIC SYSTEMS, Aument..... 2.25
- ☐ MECHANICAL PHYSICS, Vol. I, Dingle..... 2.25
- ☐ SUB-ATOMIC PHYSICS, Vol. II, Dingle..... 2.25

On receiving the books, I will pay postman prices shown above, plus a few cents C.O.D. charges. If I am not entirely satisfied with any, I have the privilege of returning them within five days. (We pay postage when you remit with order. Same satisfaction guarantee.)

Name.....
Home Address.....
City.....State.....

THE RONALD PRESS COMPANY, Publishers
15 East 26th Street ESTABLISHED 1900 New York, N. Y.

Bush Flying—Modernized

(*Continued from page 30*)

fense airports that were built for quick transfer of military machines to Alaska. Canadian Pacific planes go to Whitehorse and Dawson in the Yukon and connecting services of the United States carry the connection on to Fairbanks. Pioneered by Yukon Southern, this inland valley route was well used even before the defense airports project was undertaken. Yukon Southern's established bases and regular trips to Whitehorse from Edmonton were of tremendous benefit to Canadian and American engineers who built the five-base chain of northern airfields and the all-important defense highway to Alaska. When Canadian Pacific took over, Yukon District had the heaviest schedules of the 10 airlines, and continues today as the area of major traffic and greatest war significance. Great help in locating the Alaska highway was given by Canadian Pacific planes which took thousands of aerial photographs for U.S. engineers. Better than 50,000 pounds of airmail a month went to U.S. Army camps in Canadian Pacific ships at one time.

Branching from the Edmonton-Dawson route in the Yukon District are Canadian Pacific lines from Fort St. John southwest to Vancouver, and from there branches to Victoria and to the Zeballos mining country on Vancouver Island. Other branches in this district link Prince George and Fort St. John with Takla Lodge, Manson Creek and Fort Grahame in northern British Columbia.

The Mackenzie District extends over the Mackenzie River basin from Edmonton, the company's western headquarters, north to the Arctic areas. Its routes link with the outside such famed and vital fields as the radium mine country around Great Bear Lake in the North West Territories, and the new oil findings at Fort Norman from where the oil will some day be piped west for defense use throughout the British Columbia-Yukon-Alaska peninsula. Servicing these two areas, and carrying men and equipment to far-flung defense outposts of the northern territories are main tasks of the Mackenzie lines. On some occasions 15 to 20 Canadian Pacific aircraft work for a period on the northern pipeline project alone.

From Edmonton the main trunk of the Mackenzie District lines runs north to Fort Smith. There, at the clearing center for the north, the company has built its own field, complete with radio offices, freight buildings, and passenger facilities. North from Edmonton, on a daily service, planes go to McMurray, noted for its oil-bearing tar sands. There Canadian Pacific has built another airport, passenger buildings and 10 miles of highway connecting the field with the town. Maintenance facilities and seaplane docks have also been established at McMurray.

On to the mining areas of Chipewyan and Goldfields on Lake Athabaska and from there north through Fitzgerald, and Resolution on Great Slave Lake. There the line branches. One route goes northwest to the Norman oil country and beyond to Aklavik, and the other almost due north to Cameron Bay and finally, Coppermine. Both Aklavik and Coppermine are on the Arctic Ocean, well within the Arctic Circle. From Edmonton to Aklavik is 1,540 miles. Coppermine is about the same. These two are Canadian Pacific's longest routes, the next for straight distance being the Edmonton-Dawson run of some 1,300 miles.

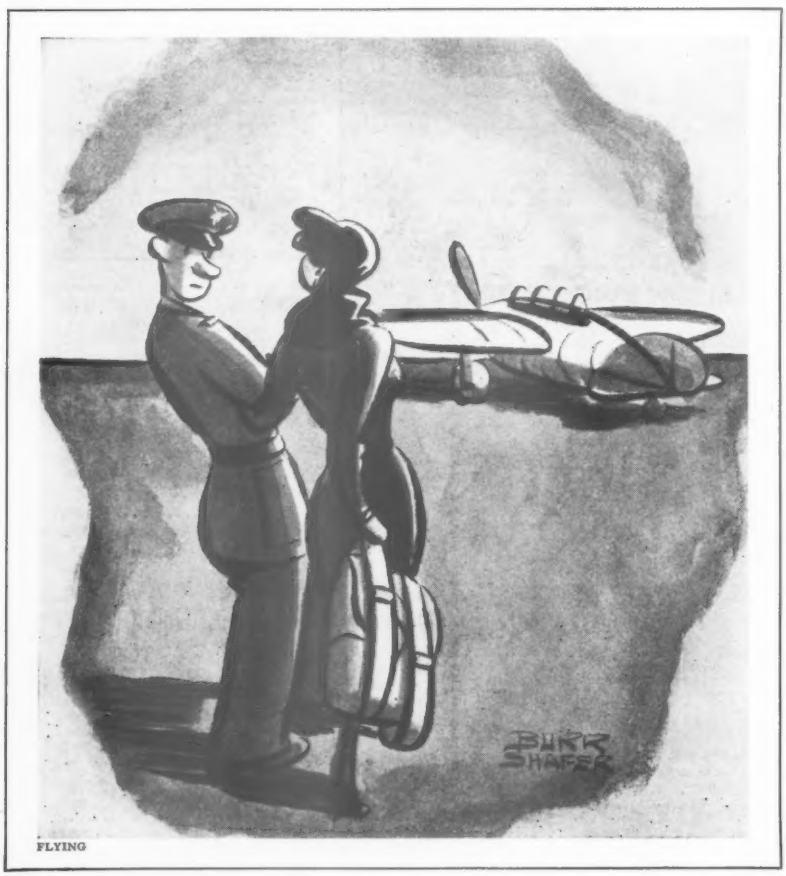
In the Saskatchewan district, north-south airlines are operated from a hub of Prince Albert. Regular connections are made with Regina, Moose Jaw, Saskatoon and North Battleford to the south, and La Loche, Goldfields and Lac La Ronge to the north. The southern section so serviced is important prairie farming country, and the northern is known for mining and furs.

The Central district, lying in Manitoba and Ontario, provides a network of air services for the gold mines that are sprinkled over the bleak, rocky, pre-Cambrian shield country which horseshoes itself around the southwest of Hudson Bay. Operations are controlled from Winnipeg, with principal stops at The Pas, Berens River, Norway House, and God's Lake.

Canadian Pacific's Eastern district provides a daily service between Montreal and Quebec City, and handles much charter work for freight and passengers into the country north of Montreal. Latest big freighting project was the carrying of hundreds of tons of goods into the Saguenay River district due north of Quebec City, where the Canadian government is completing a 1,500,000 h.p. electric power establishment.

The St. Lawrence River District has expanded air services stretching far to the northeast from Quebec City, to service outlying spots in northern Quebec and along the coast of Labrador. Considerable charter flying is undertaken in this area to carry supplies to agents of the Indian Affairs Department, Lands and Forests Division, Mines and Resources and other government agencies. Canadian Pacific freighting planes have helped the transport department establish meteorological and radio stations at far northern Quebec locations.

Thus the Canadian Pacific system blankets Canada completely. Its operating efficiency has kept pace with its increasing schedules. The company's officials conferred with major U.S. airlines to get the best theories of traffic control. A western office at Edmonton controls operations in the three western districts and a traffic office at Montreal handles the three eastern districts. Traffic representatives have been located at strategic centers in each district. Passenger offices



FLYING

MACHINE SHOP includes finest lathes and other equipment used in servicing aircraft. Students learn about shop equipment, its care, servicing and operation.

ADVANCED ENGINE SHOP Master mechanic students have the opportunity of working on planes and engines that are going into service. All types are studied.

CHEMISTRY LABORATORY is well equipped. Aeronautical engineering students learn principles of chemistry followed by qualitative analysis of aircraft metals.

America's airmen, fighting in all parts of the world, are proving their superiority with daily headline achievements of skill and courage. They are the best trained fliers in the world, which is a tribute to the excellent training program of American aviation. Lewis School of Aeronautics is a part of this gigantic program, assigned to training only flight instruction officers for the United States Navy.

After this war has been brought to a victorious end we will again be back training youth in flight, master mechanics and aeronautical engineering.

Plan your future now in aviation. Reservations are already being taken for enrollment after the war.

FREE CATALOG. Send for 42 page Lewis School catalog. Contains full information about Lewis, its facilities, equipment, faculty and courses.

LEWIS SCHOOL OF AERONAUTICS

LOCKPORT, ILLINOIS

Dept. F-6

Gentlemen . . . . Kindly send me your illustrated FREE CATALOG. I am especially interested in (check course):

☐ Aeronautical Engineering ☐ Master Mechanics Course

☐ Flight Courses

*Previous Schooling*_____ *Age*_____

*Name*_____ *City*_____

*Address*_____ *State*_____

CONTRACTORS TO THE UNITED STATES GOVERNMENT

NEXT THING TO Flying!

Hard riding motorcycle specialists in the armed forces are carrying out many adventurous, exciting assignments that take as much "nerve" as piloting a fast pursuit ship. What a proving ground for the greater Harley-Davidsons of the future—when live-wire riders can again enjoy gypsy tours, races, hillclimbs and other thrill-filled motorcycling events! Buy War Bonds now—so you can pilot a Harley-Davidson after Victory!

HARLEY-DAVIDSON MOTOR CO.
Department F, Milwaukee, Wis.

Write today for FREE copy of "Enthusiast" motorcycling magazine.

HARLEY-DAVIDSON
MOTORCYCLES

12 Beautiful Airplane Drawings
from originals by Ted Grohs
REPRODUCED ON FOTO-GLOSS ENLARGEMENT
11 x 14 Ready for Framing $1.00 ONLY

INCLUDED FREE with the above enlargement is an additional set of individual 8½x11 reproductions of the latest released Official Airplane photos. Ideal for a boy in the service. (No C.O.D. Orders please.)
SEND ORDERS TO M. B. LIBMAN CO. Dept. 2
1240 So. Main St. Los Angeles, Calif.

will soon be opened in San Francisco, Detroit and New York. Stewardess service has been organized on the Montreal-Quebec, Edmonton-Whitehorse and Edmonton-Norman runs, the last being the most northerly stewardess carrying air route in the world.

Not satisfied with running only its airlines, Canadian Pacific has plunged into two other aviation fields—operation of air training schools and management of aircraft and engine overhaul organizations. Both these wartime jobs are carried on under direct arrangement with the Canadian government.

Of these extra undertakings, President L. B. Unwin reported: "In addition to its transport operations, the company is the largest single civilian organization connected with the British Commonwealth Air Training Plan and operates, on a non-profit basis, six of the total of nine air observer schools, and one elementary flying training school. It also manages five engine overhaul and aircraft repair plants under contract to the Department of Munitions and Supply. These establishments are spread across Canada and, combined with the air transport services, are providing the nation with indispensable air facilities so necessary for the prosecution of a successful war effort."

"The immediate problem facing Canadian Pacific Air Lines is to keep pace with increasing wartime demands and to render every possible assistance to the government, armed services, and essential priority business. To perform these tasks CPAL now employs over 7,000 people in its commercial operations, air training schools and overhaul plants."

What of the post-war development generally of Canadian Pacific Air lines? There is no doubt that its operations are on the through route of world air traffic. "The ultimate northwest passage is an aerial one," Richard Finnie, Arctic explorer, wrote recently. "The short cut from New York to Tokyo is via Hudson Bay, the barren lands of the North West Territories, and Alaska. The shortest distance from Chicago to Calcutta is straight north. If you want to fly from Calgary or Edmonton to Moscow, your quickest way is across the Canadian Arctic archipelago. If you are in a hurry to get from Los Angeles or San Francisco to London or Paris, your shortest route is over Baffin Island, Greenland and Iceland. The wartime shuttling of aircraft back and forth across the North Atlantic, and the perfecting of long-range flying under all conditions, are paving the way for transpolar commerce by air when peace comes."

Something of the same keynote was struck by Canadian Pacific Air Line's president who said in looking to the future: "While the airplane today is an integral part of our wartime mechanism it should not be overlooked that commercial aviation is destined to play a major role in reshaping a post-war world. In this regard, Canadian Pacific, as a long-established worldwide transport system, that will undoubtedly through the extension of its air operations, take its natural place in the development of world trade and travel routes to meet the almost unpredictable demands of the coming air age."

END

Have You Been Grounded?

(*Continued from page* 70)

vorable, he issues the medical certificate on the spot. Then, if the routine check at headquarters reveals no discrepancies, the medical certificate stands. The Administration has the right to disapprove the report of the field examiner. There may be other and conflicting reports on this same applicant, or there may be data on his performance record which would override the importance of the physical findings. This is the great value of the central records system. But the entire stress of the Administration is to keep every pilot in the air to the extent of his capacity to fly in safety.

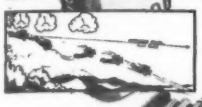
"Our job," says Dr. Stovall, "is to keep 'em flying!" An applicant who is refused medical certification by reason of structural physical defects has a right to demonstrate under actual flight test whether he is entitled to medical certification. Even if he fails the flight test he may reapply after he has obtained six hours more flying time (one-half at least of which must be dual instruction) and after each additional six hours. The examiners are under instructions to be as helpful as may be within the considerations of the public safety. An applicant who has been refused for organic physical defect is privileged to continue to submit medical evidence which might disprove the physical incapacity.

The office of the director, in general, only sees or corresponds with the marginal cases. The office is open at all times and all airmen can feel welcome there, but the only ones who come in are those who feel that they deserve a better rating than that given to them after examination or re-examination in the field. Sometimes their status is bettered by the personal visit to headquarters. At least they will go away satisfied that they have had every opportunity, for Dr. Stovall and his associates will sit down with the airman or would-be airman, discuss his physical problem with him—translate the medical terminology into language of his comprehension and show him where the defect could interfere—and assist him in any way possible to achieve all legitimate results.

There is no royal road around a structural defect since safety demands that a pilot be fit. There is less chance to hurdle an organic defect since there is no way to predict with certainty whether it will grow worse or better.

The old Superman theory of pilotage has long since been discarded. It is now recognized that a crooked or withered leg or arm, or spine even, may be as useful to one man as perfect members may be

460 ILLUS.



Revised, enlarged edition!
New edition has completely rewritten chapters, shows nature and use of latest type equipment. Special new chapter: Noiseless Flight—The Glider. Clear, instructor-to-student text and 460 pictures show every step in training for flight, instruments, radio, navigation, motors, aerodynamics, safety devices, etc. Translated into several languages. Size 7" x 9½", $3.00.

PARTIAL CONTENTS: *Take-Off and Landing . . . Turns, Climbs, and Glides . . . The Motor . . . Visual Navigation . . . Motor Oils and Gasoline . . . Simple Aerodynamics . . . Gyro and Sperry Instruments . . . Etc.*

338 ILLUS.

Weather and Instrument Flying. *Prepares you fully for written tests for instrument rating. C. R. Smith,* former President of American Airlines, says: "This book has taken the subject of meteorology out of the mathematical equations and has made it simple to understand. It explains instruments, radio, and all allied subjects thoroughly." Size 7" x 9½", $3.00.

PARTIAL CONTENTS: *How to Be a Weather Detective . . . Air Masses and Their Identification . . . Weather Maps . . . Practical Forecasting . . . Airplane Instruments . . . Cambridge Fuel-Air Ratio Indicator . . . Instrument Technique; How Not to Be Confused . . . Etc.*

451 ILLUS.

Contains the expert knowledge you must have to go beyond elementary pilot ratings. Tells how to get and use upper-air weather information, airline technique of pre-planning flights, latest instruments, icing dangers and counter measures, engine efficiency under varying conditions, special landings and take-offs, etc. Size 7" x 9½", $3.00.

PARTIAL CONTENTS: *Practical Application of Weather Knowledge . . . Shelters in Flight; Alternate Airports . . . Typical Cloud Forms . . Brasnell Instrument Method . . . Radio as a Navigational Aid . . . New Accessories . . . Etc.*

America's fighting pilots know what is in these books

LIFE-SAVING AIR KNOWLEDGE FOR EVERY AMERICAN WHO FLIES TO WIN THE WAR!

THE victories of Allied airmen in action on war fronts the world over prove that these books are doing their share to smash the Axis. They have been supplied officially to the men by the United States, Canadian, British, and Russian Governments. *400,000 copies have been printed.* Each successive edition is kept up to date. Tomorrow's aces are reading these books *today* — because they give *in advance* that thorough knowledge of aircraft, motors, instruments, radio, weather, and flight itself that means *safer* flying, *faster* training, *expert* piloting.

A TESTED WORD AND PICTURE METHOD

These books are written in natural, instructor-to-student language, easy to understand and remember. In addition, they contain *1249 illustrations,* specially prepared by experts under Jordanoff's direction. They picture every step in an airman's training, every knob and button on a control board, complete sectional views of instruments and installations, how to navigate and maneuver, how to recognize and avoid dangerous weather. Until these books were published there was no way to begin your flight training so easily and so safely. Examine them *free* in your own home. Just sign and mail the coupon and we will send you at once these tested short cuts to expert piloting. You take no risk.

This is JORDANOFF

Pilot, instructor, engineer, technician, author of *Your Wings, Through The Overcast,* and *Safety In Flight* and the newly published *The Man Behind The Flight* and *Jordanoff's Aviation Dictionary.*

WE GUARANTEE that the Jordanoff books will do for you what they have done for tens of thousands of fliers—or cost you nothing!

THREE VOLUMES BOXED, ONLY $8.00
Keep them *on approval* for 10 days. If dissatisfied return them for refund.

SEND NO MONEY!

TO: FUNK & WAGNALLS COMPANY, Dept. 560
354 Fourth Ave., New York, N. Y.

Send me the book (or books) checked at the right, for 10 days' examination. I will deposit price, plus postal charges, with the mailman, with the understanding that my money will be completely refunded if I am in any way dissatisfied and return the book (or books) 10 days after delivery.

Name.....

Address.....

City..... State.....

Books sent post FREE if you enclose payment. Same return privilege.

☐ **ALL 3 VOLUMES, boxed in a handsome slip-case, at the BARGAIN PRICE of $8.00**

☐ **YOUR WINGS, $3.00**

☐ **SAFETY IN FLIGHT, $3.00**

☐ **THROUGH THE OVERCAST, $3.00**

Any two (check which), $5.50

to another. Such considerations are individual. Some are able to demonstrate that they have compensated for their deficiencies, even in the case of amputations, by increased efficiency of other members or by mechanical devices. The applicant with such structural defects is given an opportunity in specialized tests under actual flight conditions to indicate whether his performance meets minimum requirements. These tests never require better performance than is required of a normal person, but must include work in marginal conditions of operation, such as extreme conditions of weather and fatigue or factors of attention distraction.

Organic defects, however, are more difficult to surmount. An applicant with tuberculosis, epilepsy, syphilis, diabetes or heart ailment would not ordinarily be a safe pilot. Whenever conditions exist which might suddenly evidence themselves in hemorrhage, coma, fits or mental lapses, the burden of proof is heavily on the side of the applicant for medical certification. In the case of defects which may prove temporary, medical certification is denied only until such conditions have been corrected or cease to exist, as in the case of a fractured leg, appendicitis operation, hernia, pregnancy or protracted illness.

Eye defects are the commonest cause for contention. Wiley Post and Coli of France set high standards of pilotage—yet they were one-eyed men. Many good pilots wear corrective glasses and some wear contact lenses. It is possible to pass for a Class 1 medical certificate, eyes as far off as 20-50 if they can be corrected to 20-20 by glasses, since the factors which operate to prevent glasses from giving normal vision do not ordinarily become of significance until vision without correction is poorer than 20-50. Yet the fact cannot be ignored that such adjustments rarely, if ever, reach the equivalent of normal vision. All glasses limit the field of vision and by the fact of "corrective pull" increase fatigue; while there is always the chance of dirty or fogged lenses, twisted frames which distort the view, or breakage—and of course the mere correction of an individual's vision to the conventional mathematical norm of 20-20 by glasses does not assure that he has the best lens combination for his particular eye condition. In the case of the one-eyed pilot, the field of vision is definitely limited, fatigue comes sooner, depth perception is deficient and injury to that one eye means total blindness since he has no spare.

Still, there are individuals of exceptional ability who are one-eyed or glasses-wearing who can demonstrate in actual flight that they can do the work to a degree commensurate with the public safety. It is for such exceptional individuals that provision has been made in the Civil Aeronautics Regulations for the waiver of certain physical standards.

The first difficulty is to formulate tests which will be accurate in measuring the capacity of the pilot who desires to demonstrate his ability to overcome his physical handicaps. The second difficulty is to apply uniformly all such tests in the field. Some of the flight examiners go very thoroughly into any case in hand, while others, not keen for the job, quickly find that their fellow pilot handles the ship well and let it go at that, with some such report as, "This fellow flies as well as I do!" The series of tests now being used for each general type of structural physical defect indicates to the serious flight examiner the surest methods of determining the extent to which the applicant has overcome his handicap.

A feature of the examination of the airman not present in other examinations is that the applicant is often trying to impress the examiner that he is a better man than he is. Instead of aiding to find out what is wrong with him, the birdman is doing his best to conceal known weaknesses and much malarkey has to be cleared away before the facts are revealed.

There is often operative in these examinations, both in the laboratory and in the field tests, the human desire to rise above personal handicaps. Frequently the original desire to become a pilot, or to advance to a better class rating, is traceable to this natural urge on the part of the candidate to demonstrate to himself and to the world that he is just as good a man as his more favored brother. This fact has pushed many crippled or ill pilots on to great feats of pilotage, but it proves nothing except that human nature is human nature!

Additional fairness to the handicapped applicant is evidenced in the latest "Handbook for Medical Examiners" issued by the CAA, in which the examiners are instructed to consider whether the candidate is suffering from unusual fatigue or nervousness at the time the test is taken. When a pilot has come a long distance, in a great hurry, without proper sleep or nourishment en route in order to be examined, and has had to perform for the medical examiner when below his normal physical or mental condition, the medical examiner is instructed to consider these factors, and may postpone the examination, or repeat parts of it until the candidate can do himself justice.

The introduction on September 1, 1942, of the permanent airman certificate was accepted with great joy by all pilots. It has, moreover, simplified the executive, examining and clerical work of the CAA by an estimated 32 man years, annually. The airman certificate once issued now is good until it is revoked. All the holder has to be sure about is that the medical certificate which must accompany the airman certificate is in order and that he is properly checked out. This means that an air line transport pilot may not function at his job unless he has a medical certificate issued within the six preceding calendar months, and all other categories, within the preceding 12 calendar months.

Yes! The pilot, and the candidate for pilot training does get a square deal—and this is increasingly the fact. The new tests are all to his advantage as well as being in the interests of the public and of aviation in general. Surely nobody knows the hazards of flight any better

FLYING

"They think we're spiders!"

WANTED...

MEN FROM NON-ESSENTIAL OCCUPATIONS

to train for non-combatant jobs in the field of aviation

AN OPPORTUNITY for married men with families who face an immediate readjustment in occupation...

WHO NEED an income above the average to maintain their home, family and obligations...

TO LEARN aircraft instrument maintenance, calibration and overhaul...

TO ACCEPT a responsible position with Ford...Martin Aircraft...Bell Aircraft...Pan American...or with one of the many other leading manufacturers and airlines who have already asked us for more men than we can possibly train in months to come.

OR CHOOSE a career in Civil Service as an aircraft instrument technician at one of the Civil Service manned air bases. Our training qualifies you for these positions. Civil Service requires NO EXAMINATION or FURTHER EXPERIENCE from graduates.

NATIONAL RECOGNITION

Graduates with leading companies and at air bases the world over. Eighty-five percent of the school facilities are used for training instrument technicians for the Army Air Forces Technical Training Command and Air Service Command. School is approved by Civil Aeronautics Administration as a certified repair base (No. 1537) —registered by the Illinois Department of Education.

★

Because of war training activities, only 15 civilian students a month can be accommodated...so investigate now.

Evening classes permit daytime occupation. Don't wait till your job is put on the "non-essential" list. Write today, to learn of the opportunities in this well paid branch of Aviation science. Age is no handicap—Send now for catalog describing training, costs, terms, etc.

Chicago SCHOOL OF AIRCRAFT INSTRUMENTS

Division of Industrial Training Institute

2200 LAWRENCE AVENUE · DEPT. F-6 · CHICAGO, ILLINOIS

Let Generals ARNOLD and EAKER help you plot your course in Military Aviation

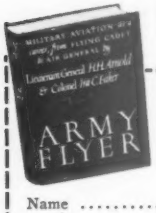
General H. H. Arnold and Major General Ira C. Eaker have written this helpful book

ARMY FLYER

Military Aviation as a Career from Flying Cadet to Air General

THESE two army airmen pick you up as a fledgling in your cadet flying days, tell you what to expect and how to meet your obligations during training at the schools; how to report and the responsibilities you will meet in your first tactical unit; cover every routine and special duty of the cadet from the moment he enters the service right up to the highest rank he can attain. An absolutely indispensable handbook for the Air Forces officer. Find out now what is in store for you and how you will win your wings in the Army.

"No army airman will want to be without it because of the time it will save and the errors it will prevent. From recruit to general, the book provides clear, authentic instructions."—*N. Y. Sun.* $2.50



Examine it FREE for 5 days

HARPER & BROTHERS
49 East 33d St., New York

Please send me a copy of "Army Flyer." I will remit $2.50 plus postage within five days or return the book. F-6

Name .....
Address .....
City ..... State .....
Business reference .....
.....

☐ Check here if you enclose $2.50 with order, in which case we pay postage. Same return and refund privilege.

than the pilot himself, and he would never willingly increase them. Under present conditions—to take a concrete example—in a case where the laboratory tests indicate eyesight which is unbalanced to the extent that depth perception or color perception would be deficient, and the examiner so rules, the candidate may demand a flight test. And if he can demonstrate that he actually can compensate for these defects of vision by ability, experience or the use of other faculties—in short, if he can form a correct visual judgment under marginal conditions of flight he can get a medical certificate.

An added feature of medical certification of late has been the reciprocal granting of such certificates to any member of the military services of the United States who presents proper evidence of "pilot status, solo," without the necessity of passing the prescribed physical examination. At present these reciprocal medical certificates are being issued at the rate of 250 per month.

The examinations are being conducted in the light of humanized scientific methods. The more candidates to whom the CAA can issue proper certification, the higher ratings it can give to each candidate, the better it is satisfied that it has done the job to keep 'em flying!

END

The Invasion Has Started!

(*Continued from page* 23)

than five per cent. The natural thing to expect—and critics of the AAF daylight operations have prophesied it—is that losses in daylight operations would be higher. There is reason to believe, however, that the 8th Air Force's losses so far this year have been under three per cent, which would be phenomenally low.

No, despite such persuasive bystanders as Allan Michie (see "The Library" elsewhere in this issue), the necessary requirement is not abandonment of daylight raids on Germany, but stepping up the scope of both day and night attacks, hitting more targets, blasting them more heavily, coming back to them more frequently. It is to hit so hard, and in so many scattered places at the same time, that the Luftwaffe, already declining in strength, will be unable to cope with the air armadas that are pounding Europe. It is to keep the bombardment going day and night, without respite, forcing Germany to man her defenses constantly, instead of at night only.

That, in fact, is just what is in store for the enemy—a ceaseless, relentless pounding, by all types, at all hours. The experimental stage is over, says General Eaker, and the next step is to build up the strength of both AAF and RAF—but particularly to swell the numbers of American bombers until the 8th Air Force is operating on a full partnership basis with the RAF.

The new and bigger planes to make this possible are on the way, he reports, carrying three to four times the bomb loads of the *Fortresses* and *Liberators*. And by summer, hundreds of American bombers will be operating from Britain, cooperating closely with the RAF, and able to choose targets at will throughout Germany or western Europe. The day and night offensive will be so mighty that "we won't give a damn whether the Germans know we are coming or not."

Admitting that when the *Fortresses* raided the freight yard at Rouen last August the planes designed for hemispheric defense were coming up against the kind of "big league" opposition they were not intended specifically to meet, General Eaker said many experts—American as well as British—confidently expected them to fail. But they didn't, and he asserted the British themselves now were convinced of the soundness and practicability of daylight, high-altitude operations over western Europe.

This was borne out by the RAF itself in April, in a review of studies of reconnaissance photographs. The consensus at RAF headquarters was that American heavy bombers, in their daylight attack March 18 at Vegesack, had struck what may have been the heaviest blow of the war against German U-boat operations.

The bombers inflicted heavy damage on seven of the 15 U-boat pens, and submarine experts expressed belief the production of the yard would be impaired for several months. The RAF praised the AAF raids on the Hamm railway junction, on Rennes—where a naval stores station was badly damaged—and on Wilhelmshaven, where nearly all the harbor fixtures were damaged.

Of the April 4 raid on the Renault works at Billancourt outside Paris, the RAF reported that although full reconnaissance studies had not been completed, the attack was without doubt extremely successful, with hardly a single building in the entire plant area escaping damage.

So much for the practicability of daylight bombing over Europe. It is practical, all right—pays big dividends. And all critics to the contrary, the American heavy bombers have the speed and the firepower to defend themselves and carry out their mission, even in the face of heavy fighter opposition. That has been demonstrated so amply that the point is no longer worth belaboring. It's still thrown into the argument by night-minded critics of the American heavy bombers, but their assertions of inadequate firepower, armor and speed don't stand up under scrutiny.

The bomb-load criticism is more valid. Designed for long-range defense, the *Fortress* and *Liberator* carried normally 6,000 to 10,000 pounds of bombs, as against about 16,000 pounds in the large British bombers. But the bigger planes are on the way, and so are more *Fortresses* and *Liberators* with greatly increased bomb loads. Other lessons have

There is an *unlimited* demand for

ROOSEVELT TRAINED MECHANICS

to help

That is why ROOSEVELT AVIATION SCHOOL is emphasizing its highly specialized

MASTER AIRPLANE AND ENGINE MECHANIC COURSE

as essential Career Training which fits the graduate to meet every requirement for Civilian Employment as a Maintenance Mechanic on Army Airplanes and on Commercial Airplanes.

If it averages *twenty* mechanics to keep *one* airplane in the air, it will take 1,000,000 mechanics to keep 50,000 planes in the air.

No other type of expert is as badly needed as the Master Airplane and Engine Mechanic.

If you want a training that will put you *to* work and keep you *at* work—*now and after the war*—sign and mail the coupon below and *do it now.*

We can accept only thirty students per month.

1943 Classes Start Monday, March 1, and every fourth Monday thereafter.

SIGN AND MAIL THIS COUPON AND DO IT NOW!

ROOSEVELT AVIATION SCHOOL, At Roosevelt Field, Mineola, L. I., New York

Gentlemen: Without obligating me, please send details regarding your highly specialized

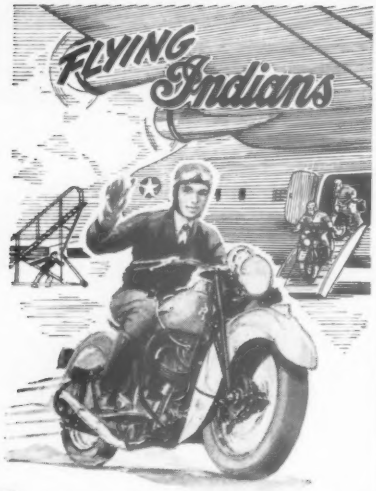
MASTER AIRPLANE AND ENGINE MECHANIC COURSE

Name..... *Age*.....

Street Address.....

Town..... *State*.....

F. A. June, 1943



GIANT AIR TRANSPORTS now fly Indian Motorcycles to our fighting fronts all over the world. Red-blooded fighters are riding Indians into action everywhere, proving every day the dependability, power, and safety that have made Indian the greatest name in motorcycles for forty years.

Indian improvements are undergoing gruelling tests in today's rough-and-tumble warfare. That's the reason why, after the war, you'll have new and better Indians to ride . . . machines with a new measure of proven dependability and safety for sport and economical transportation.

If you're a motorcycle rider now, keep in touch with your local Indian dealer. He'll help you keep your present machine in shape till you can buy a new Indian.

INDIAN MOTOCYCLE COMPANY, SPRINGFIELD, MASS.

Indian

BUY WAR BONDS NOW
★ ★ TO BUY AN INDIAN LATER ★ ★

Learning to Fly?

YOU'LL NEED THIS BOOK!

From The Ground Up

by
SANDY A. F. MacDONALD
Formerly Chief Air Navigation Instructor
No. 20 E.F.T.S.
British Commonwealth Air Training Scheme
Now Serving with the R.A.F. Ferry Command

Completely covers
ELEMENTARY AIR NAVIGATION
THEORY OF FLIGHT
METEOROLOGY • AIRMANSHIP
ENGINES • AIR FRAMES

$1.00 Do Not Send Stamps
POSTPAID TO YOUR ADDRESS
AVIATION SERVICE CORPORATION LIMITED
19 Maynard Ave., Toronto, Ont.

been learned, too, such as the need for greater armor protection against low-velocity explosive shells, and the necessary changes have been adopted.

This extensive discussion of American types and their success might indicate a belief that the AAF had all the answers, and would throw all the weight. It should be obvious, however, that there is no such implication. There is only the explanation that, in Europe, the American heavy bombers are doing—and doing quite well—a job that is bigger than the one for which they were designed. In cooperation with the RAF, American airmen will carry their full share of the load, although so far the RAF manifestly is way ahead of them in tons of bombs dropped and damage inflicted. The cooperation is a fact, and the pattern set. The job has started.

But it's a long way from finished. General Eaker speaks of "hundreds" of American bombers by summer, of AAF strength in Britain equalling RAF strength. But as yet the largest number of American heavy bombers to be announced as participating in a single raid was 133, in the assault on the Renault plant. If the RAF is unable to repeat frequently its 1,000-plane raids, at least part of the difficulty may be disagreement with the Admiralty as to the most profitable occupation for heavy bombers.

The 1,000-plane raids were accomplished only by "borrowing" some of the planes normally engaged in operations at sea, patrolling the vital approaches to Britain, seeking the U-boats lying in wait for convoys. The Admiralty quite obviously regards this as an essential operation, and rightly so. The RAF thinks it is productive of greater results to hammer the U-boat bases. It's a difference of opinion not likely to be resolved.

To carry on 1,000-plane raids every night, if the maximum "profitable" operational loss is used—five per cent—would require a replacement rate of 1,500 planes monthly. Assume that there was a further net reduction of 600 planes (a conservative figure) by reason of landing and take-off accidents, damage from antiaircraft, and other reasons. That means replacements at the rate of better than 2,000 planes a month would be required for nightly 1,000-plane raids by the RAF alone. Even for raids of that size three nights a week, the replacement-and-repair rate would run around 1,000 a month. And to start such operations, a force of at least 3,000 planes—preferably 4,000—would be required.

Then add to this the AAF participation in round-the-clock operations. Assume, for instance, that attacking specific targets instead of area targets, a comparable amount of effective destruction can be inflicted on enemy installations with one-third the total plane strength (disregarding, for the sake of the point, the question of bomb load). That would mean 300 planes a day operating over Europe. An initial strength of 1,000 is indicated, and replacement-and-repair, figured on the same basis as for the RAF above, would be about 600 a month. For three-days-a-week operations on this scale, assume replacements would total 150 bombers a month.

What does it add up to? Initial combined strength of 5,000 heavy bombers, with replacement-and-repair totalling 2,600 a month. Nor is plane production the only factor to be considered. Every bomber lost means a crew lost, too, and at 2,000 heavy bombers a month that would mean replacement of some 18,000 trained crewmen—pilots, navigators, bombardiers, radiomen, gunners. Will the training facilities of the two countries provide air crews in any such numbers as that?

Furthermore, the beginning of operations on such a scale would require the accumulation of huge amounts of aviation fuel. Britain produces none—every gallon of gasoline has to be imported and that imposes a tremendous load on an already heavily overtaxed merchant marine. The U-boat menace will have to be diminished before U.S. and British airmen can feel completely safe on that score.

That is, of course, much too gloomy a picture. Few of the operations over the continent have exacted the five per cent toll. As the size and frequency of combined RAF-AAF attacks increase, the toll can be expected to drop. Already, the Nazi defenses have their hands more than full; it is highly unlikely, with their strength declining as it is, that they can inflict maximum penalty on the growing attacking forces.

Lips That Touch——

For what it's worth, we offer the unofficial report from the Middle East that Germany's Heinkel He-111 bomber, with a full crew and equipment, can haul exactly 6,400 cans of beer. That contribution to the science of logistics was furnished by Allied airmen who recently captured a Heinkel. Exactly how much captured German beer Allied airmen can carry is a matter of deepest speculation—an enviable speculation.

From "Air Force" Magazine

Nor is it necessary to assume that continuous operations of such huge size will be necessary to soften up the continent to the point at which an airborne and amphibian landing of Allied ground forces would usher in the final stage of the war in Europe. But a tremendous backlog of strength is required for any continual, large-scale attack.

Continuous, round-the-clock bombardment of Europe on such a stupendous scale may come eventually. Certain it is that the scale of operations is growing now and will continue to grow. Bad weather may ground the heavy bombers occasionally, but not with sufficient frequency to give the Nazis much comfort or respite.

The culmination of this aerial blasting, the landing of Allied troops on the soil of Nazi-occupied Europe, has been promised this year. The campaign is underway, as every day's headlines demonstrate. The invasion has started.

END

School of Aeronautics

CLAIM YOUR PLACE IN THE AIR AGE . . .

CIVIL and Military Aviation have received such impetus from the war that there's no doubt Aviation offers an unparalleled opportunity for technically trained men.

The field is so vast and so highly specialized that an outsider hardly knows where to seek his place. He needs *guidance* to select the branch of the industry where men are most needed—and thorough *training* to fit himself for opportunities that exist now and promise permanent security.

Get off to a good start by enrolling in a school that has a long-standing reputation for turning out graduates who are thoroughly trained in their specialties.

Stewart Technical School has grown up with Aviation. It is government-approved—is now devoting all of its aircraft mechanic facilities to training enlisted men of the Army Air Forces. But courses in Aeronautical Drafting and Detail Design are still open to civilians.

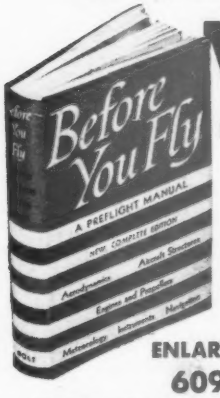
Complete Information on Courses furnished on request. Write for Catalogue 12F.

SCHOOL OF AERONAUTICS
STEWART TECHNICAL SCHOOL
FOUNDED IN 1909 • SPECIALIZING IN AERONAUTICS SINCE 1929

STEWART TECH BUILDING, 253-5-7 W. 64th ST., NEW YORK, N. Y.

Get your pre-flight training quickly and easily from this *ground-school tested* pre-flight manual

Before You Fly



ENLARGED EDITION
609 PAGES
With 401 Illustrations and Diagrams

By *Pearle Robinson; F. A. Middleton; G. M. Rawlins, Jr.;* and J. W. Phillips, Major, U.S.A., on duty with the Air Forces.

BEFORE a single word of this book was printed, it was tried out on the young men and women in the schools of a great city. The result is a book unlike any other on planes and flying—a book you can rely on to guide you to the aviation career that is right for you, and give you the right start in the branch you choose. Everything you need to know before actually flying is in this book, clearly, simply, excitingly described in words and pictures.

PARTIAL CONTENTS

Army, Navy, and commercial aviation . . . Basic laws of physics affecting flight . . . Controlling the airplane . . . How airplanes are built . . . Airplane maintenance . . . Airplane spotting . . . Engines and Propellers . . . Fuels, lubrication . . . Carburetor, supercharger, ignition system . . . Instruments, Meterology . . . etc.

WE GUARANTEE

Your complete satisfaction or money back. Order by mail now. If you are in any way dissatisfied, return *Before You Fly* within 5 days for a complete refund.

TO: HENRY HOLT AND COMPANY
257 Fourth Ave., New York, N. Y.

Send me *Before You Fly*. I enclose remittance of $2.75 (or C.O.D. if you check here ☐).

NAME

ADDRESS

CITY & STATE

Riding the 'Lightning'

(*Continued from page 45*)

not need any help from me to know where he was. He knew all along and I had just found out. The wing went down, we swung back the three or four miles we had traveled in the last few seconds and slid down through a hole in a spiral dive. I caught a glimpse of the circular rainbow around our shadow on the shining white cumulus and then we were going through while I wondered about the traffic in the valley air below us. We broke out in the clear, dodged under a big patch of cloud (while I wondered about the hills that I knew were on the other side), and banked around for the airport. I made a suggestion about starting up the dead engine but Jimmy said "Why bother, it flies fine on one." I shut up and the pilot concentrated on working off some excess air speed without pulling back up into the clouds. We gobbled up the full width of the valley getting down to a slow 175 m.p.h. where we could put the wheels down. Polished aluminum spots on the camouflaged nacelles provided reassuring mirrors in which we could see the nose wheel. Jimmy started the other engine and we squared away for a landing.

The approach was easy and perfectly normal with the flaps going down in the last three quarters of a mile at about 1,000 or 1,500 feet. The glide is done power-off with the nose down only a little, a fairly high rate of sink, and with a quick flare-out just before touching down. Once the main wheels are on, the nose goes down and the tricycle gear rolls straight ahead. Jimmy made it look almost too easy, although he claims that any pilot can land this airplane. The air-speed said an even 100 when we touched, although the ship can be landed at 80 m.p.h.

The stop watch said 20 minutes and six seconds and we had really been places. I had a grin a mile wide and felt like Jimmie Doolittle although all I had done was take a routine airplane ride . . . and get myself a fine case of P-38 fever. Looking for facts to back up my roaring enthusiasm I discovered some mighty intriguing things about my new aeronautical love.

First of all, the *Lightning* originated as an intercepter, but as its versatility was discovered, it turned into the all around airplane of the Army Air Forces on all the fighting fronts. It is used as intercepter, fighter, attack plane, light bomber, camera plane—in short it does a bit of everything and does it well. It's utility stems from its 2,300 hp. twin engines.

The P-38 wing lifts a terrific load, permits an airspeed of "well over 400" and yet provides for the low landing speed of 80. Though the wing is loaded at the unusually high weight of 48 pounds per square foot, the plane still maneuvers effectively against fighters having half this wing loading. A special maneuvering flap of Lockheed design permits the ship to be slowed up for fighting without sacrificing speed when it's needed.

The lines are so clean that 60 per cent of the plane's drag is in the tricycle gear before it is retracted. The drag of the remaining 40 per cent in flight is less than that of an ordinary card table 27 inches square. Lockheed engineers have perfected a method of computing the diving speed of the plane (still a secret) as airspeed indicators fail far below terminal velocity and record only a "shock wave" of air which has no bearing on the true speed.

The *Lightning* is a big airplane. Gross weight is 13,500 pounds, it has a 53-foot wing span and is 37 ft. 10 in. long, yet it stands only 9 ft. 9 in. high to the tip of the props. Figuring roughly, it's half the size of a Douglas DC-3. Part of its weight is in extra armor for the pilot, a great deal is in self-sealing fuel tanks and armament, but most of it is in rugged construction. All this weight, plus its power and streamlining, give the plane the ability to zoom for thousands of feet in combat where this ability is a vital consideration.

Many of the P-38's unique features are proving invaluable in the combat areas. Back from the fronts come glowing reports. The air officers of our Army who fly this ship go into real raves about it. They tell of the *Lightning* camera plane in the Coral Sea area which ran away from three flights of pursuing Zero fighters although it had one engine disabled. They tell of bombing missions in North Africa where P-38's go all the way with the bombers on their long hops and run the Messerschmitts ragged while doing a little free-hand bombing on their own. A *Lightning* in the Aleutians came home with bullet holes stitched up and down both sides of its rugged twin booms—punishment which could, and did, annihilate the Lockheed's Zero opponent. Ribless wings, double-skinned and double stressed, bring damaged *Lightnings* home on one or both engines time after time. If the skin is torn up by enemy fire the massive spar holds the wing together. If the spar is damaged, the skin takes over the load.

Special brackets under the wings hold bombs or belly tanks. These belly tanks were put in production after Lockheed wind tunnel tests on 31 designs. The final result has twice the capacity of early tanks. The tanks are made in two sizes. A pair of the 150 gallon variety give the P-38 an effective combat range of 750 miles—and that's a long range for a fighter. The Army no longer withholds the information that these ships are flown to fighting fronts all over the world, thereby saving shipping space and time. [The Army has released figures giving the normal range of the P-38, fully loaded, as 1,000 miles. This figure, as well as the 750-mile combat range, may be considered as "conservative," if view of customary Army procedure in announcing warplane performance.—Ed.] Without the tanks, the plane has a wider range than most fighters, even when the P-38 has a full armament load.

There is a definite need and a place for women in Aviation. Hundreds who have trained at our school now hold responsible positions . . . Link Trainer Operators, Flight Instructors, Radio Technicians, Sheet Metal Workers, Welders, and Riviters. Their courage and foresight in training will hasten our Victory and will enable them to share equally in the peacetime development and expansion of this great industry.

DALLAS AVIATION SCHOOL & AIR COLLEGE

MAJOR W. F. LONG, Dallas Aviation School,
Love Field, Dallas, Texas.

LOVE FIELD, DALLAS, TEXAS

Without obligation, please send your catalog to:

Name..... Age.....

Address.....

City..... State.....

PA-6-43

GO AHEAD....

Time is short. Guns, planes, tanks, ships —all the munitions of war must be kept rolling off production lines with doubled and quadrupled speed, ever increasing 'til the battle is won.

Guard your drafting room against the delays inferior pencils may cause. Specify KOH-I-NOOR Drawing Pencils — accurate in degree distinction—smooth and trouble-free in performance—the choice of discriminating draftsmen for over fifty years. One or more of the seventeen unvarying degrees will do the job.

★ ★ ★

"Go Ahead with Koh-I-Noor"

#1700 TECHNICRAYON PENCILS with small diameter lead, slightly soluble in water, are manufactured in 40 colors.

★ ★ ★

Send for FREE booklet No. 17

KOH-I-NOOR
PENCIL COMPANY INC.
373 FOURTH AVENUE · NEW YORK

DARNELL
CASTERS & WHEELS

Reduce Floor Wear to a minimum.

Increase efficiency of employees.

Eliminate wracking of equipment.

Save time, speed up production.

A SAVING AT EVERY TURN

Write for FREE MANUAL

DARNELL CORP. LTD., 60 WALKER ST., NEW YORK, N.Y.
LONG BEACH, CALIFORNIA, 36 N. CLINTON, CHICAGO, ILL.

Speaking of armament: the four big machine guns and cannon with which most P-38's are armed, are concentrated right in the nose where they fire straight ahead. There is no cone of fire, as in wing mountings, with a converging pattern up to the "ideal range" and a scattering of lead beyond that. The fire from a *Lightning's* nose is a solid blast of shot that's effective straight ahead up to the range of the guns. Up Alaska way a flight of P-38's shot down five Zeros and a four-engined flying boat in a single dive! And the P-38 can pack around enough ammunition to really do a job. Unspecifically it carries more than the Jap Zero, and many other able fighters . . . enough to give it tremendous potential firing time. In comparative firing tests the *Lightning* is fired last. Other fighters damage a standard target, but by the time the Lockheed's guns are emptied the target has been blown to bits.

The P-38 has another combat advantage over both single and twin-engined fighters. Its engines turn in opposite directions and the ship runs straight and true on the ground or in the air under full power. Many Nazi ships were shot down after it was discovered that they could pull out of a dive only to the right. The P-38 turns to right or left with equal ease at any time, making it an easy ship to fly and gives it excellent handling characteristics. A test pilot stated that the P-38 was the sweetest handling military airplane he had ever flown. He claims he has seen pilots slow roll the ship, with one engine cut, 50 feet off the ground—and rolling into the dead engine. He claims that stall characteristics are perfect, that the plane hasn't a flying bug in it. I quote him because he is working for a competitive company and is completely unbiased.

Until recently you've heard little about the P-38 in combat. It was deliberately held out of action until it was completely perfected. When it went in, it went in on a big scale and is doing a sensational job.

END

Aerial Watch on America's Food

(*Continued from page* 47)

ders the centers of the adjoining photographs.

The method of flying and photographing an area can be compared somewhat to moving a lawn, wherein each strip would overlap sideways one-third of the previous strip. In the arrangement where the aerial camera is mounted vertically in the ship back of the pilot's seat, the photographer sits or kneels behind the camera in position to make it level at the instant the picture is taken. In this way he can watch the country through the viewfinder so as to make certain the successive exposures are made at the correct interval of time, thus insuring not only proper overlap along the line of flight, but also that the entire area is in the picture.

Modern aerial mapping cameras are equipped with automatic equipment and synchronized stop watches so that the photographer can devote all his time to levelling his camera, checking intervals and performing other adjustments.

Under normal wind conditions and at an air speed of 120 m.p.h., a picture is shot every 40 seconds. After the adjustments are set, it is all automatic. On each flight 200 negatives, 9 by 9, are exposed. For Government work, specifications are that they be shot to the scale of 1 inch to 1,666 feet, which means that the plane must fly at an altitude of approximately 14,000 feet, using an 8¼ inch lens.

The higher the ship flies above the ground, the greater becomes the area that can be included in one picture; consequently, the smaller becomes the scale of the picture. Knowing the plane's altitude and the focal length of the lens, it is easy to compute the average scale of the resulting photograph.

The use of oxygen equipment in mapping is recommended for any flight above 12,000 feet. Breathing oxygen, the men are enabled to maintain their efficiency throughout a full mapping day. It has been found that the mixing action which takes place in a properly designed mask and intake sack is essential to the maintenance of normal respiration and does not have a harmful effect upon the teeth.

Weather conditions constitute a major factor in crop survey aerial photography. The relative difficulties due to prevailing visibility of ground areas during the period in which the photographs are being shot resulted in the publication by the U. S. Weather Bureau of a "cloudiness map." Conditions of haze, smoke, heavy cross winds or extremely rough flying

conditions materially reduce the number of otherwise suitable days for making aerial pictures. Consequently, an index has been set at 0.1 cloudiness. It has been necessary, also, to devise a reporting system for the contractors and the Weather Bureau to correlate effectively the quantity and quality of coverage with the overshadowing conditions in all areas. Over such a large expanse as that of almost 1,000,000 square miles and involving the operations of more than a dozen contractors using 50 or 60 plane crews, conditions involving visibility, breakdown, sequences of flight as required by the agency, and other interferences of similar nature are necessarily all included and evaluated.

There is much more to aerial crop survey photography than merely sending out a capable pilot and photographer. The vision available to cameraman and pilot; the size, power and speed of the airplane, must be adequate for the work. It is expedient that the plane be handled easily and safely under all conditions, well maintained and quiet, warm and comfortable, in order to sustain the efficiency of the crew throughout a long day—in other words, conditions must be such that the men can devote full attention to their work.

Pre-flight preparation for mapping includes determining the altitude at which the plane must fly. For instance, if the selected area is to be mapped to the scale of $1'' = 800'$ and a 12-inch lens is to be used, the planners would multiply the two factors to determine 9,600 feet above the datum plane as a constant in the survey flight. The planner outlines the area to be covered on maps and also indicates the flight lines to be followed. This map, with its markings, is the flight guide.

A photograph map has many advantages over other types of maps. It can be prepared at about half the cost of topographic survey maps, and in a fraction of the time usually required for mapping. Even more important than the saving in time and money, is the fact that it is much more complete in visual detail than any other form of map. Every building, each sizable tree, paths and even trails in the area are recorded in their relative location.

Upon development in the laboratories, a contact print is made from each negative. Next comes the most painstaking part of the procedure. An airplane in flight cannot possibly be held to an exact level for any appreciable length of time. Therefore, in one print, one inch may represent 1,700 feet, in another only 1,600 feet. To correct this, the map makers measure known distances in the picture, such as railroad lines, or stretches of highway; then the print is rephotographed with very delicate adjustment of the enlarging camera to bring it to the specified scale.

Before it reaches the stage of actually taking pictures from the air and making maps from them, the Department of Agriculture must decide how many acres of various crops will be needed and each state's fair proportion. Each state's quota is apportioned among the counties suited to particular crops. Then each county association of farmers apportions the county's quota among the individual farms.

The aerial survey maps are brought into use. After finding out the exact acreage of each farm and of each field (this is done quickly from the maps—a minute or so for a farm on which a surveyor would have to spend an entire day) inspectors carry the aerial maps out to the farms and check on details of the farmer's plan. From these reports the county association allots the acreage the farmer may plant in a certain crop if he wishes to comply with the AAA plan and participate in the benefits—cash at the end of the season for staying within his limits, and doing certain things to improve the soil. The air maps are used further by the inspectors to determine whether the farmer is fulfilling his agreement.

Actual photographs average $3 per square mile; the final maps cost about $35 each. A total of about 333,000 of them is necessary for the entire country. Therefore, $15,000,000, including duplicate prints, retakes and other incidentals, is the cost of taking an aerial picture of the existing United States crop acreage. If surveyors and their field crews attempted to produce a map in similar detail, the expense would run into figures almost astronomical.

The combination of the airplane and the camera has given this country an important multi-purpose war weapon, one of the most significant of which is invaluable aid in surveying farm lands so that food production may attain the peak efficiency so necessary for the successful prosecution of the war.

END

If he could only see me Now!

There's one guy back in Florida who would get just as big a bang out of this as I do—my first instructor. And in a way, he got the Zero, not me. I wouldn't have been up there in the sun when they came over this morning if he hadn't had the confidence and patience during those first hours. Sometimes I think the primary instructors are the guys that are really winning the War.

INSTRUCTORS NEEDED IMMEDIATELY!

Flight instructors, ground school instructors, engine, sheet metal, aircraft instructors—we need you to help us carry on the vital job of training U. S. Army Cadets. Wire or write us today for full details.

Send for our free beautifully illustrated 24 page booklet giving details of our aviation specialist courses. ***Address Dept. 3.***

"Keep 'em Flying"

Embry Riddle

SCHOOL OF AVIATION

3240 N. W. 27th AVENUE • MIAMI, FLORIDA

F-643

Name_____

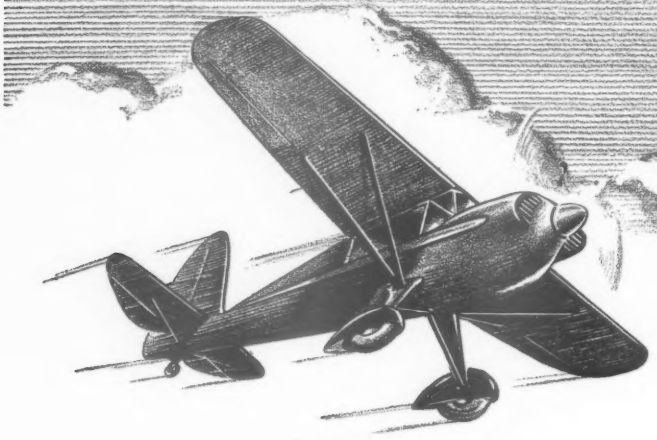
Address_____

City_____ State_____

Contractors to

UNITED STATES ARMY AIR FORCES
CIVIL AERONAUTICS ADMINISTRATION
ROYAL AIR FORCE

Keep Up The Great Work, AOPA!



"You have been doing great work in furthering private aviation. Keep it up—we all appreciate it."

BURDETT A. STERNBERG
AOPA Pilot No. 5711

☆ ☆ ☆ ☆ ☆

An unsolicited commendation: spontaneous tribute for a job well done! Regularly, the AOPA receives these notes of acclaim . . . voluntary testimonials saluting AOPA for its personalized money-saving services.

Registered AOPA Pilots throughout America have expressed their great appreciation for the dauntless pre-war leadership of this non-profit organization, for the vital work it is now doing in coordinating non-scheduled flying with the war effort, and for the important role it will have in aviation after we win the war.

If you are a non-scheduled pilot who has soloed and you are not already wearing the distinctive wings of AOPA, you should learn at once how you can participate in the significant war-time activities of AOPA, how you can become a registered pilot of the one pilot's organization that is now building a sound foundation for private flying's glorious future. Write or send the convenient coupon today for complete information.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AIRCRAFT OWNERS AND PILOTS ASSOCIATION
Washington Service Office, Dept. F643
1003 K Street, NW
Washington, D.C.

Please send me full particulars on how I can take part in the activities of the AOPA.

NAME.....
(Please Print)

ADDRESS.....

CITY & STATE.....

PILOT LICENSE NUMBER.....
(Sent only to aircraft owners or non-scheduled pilots who have soloed.)

REGISTRAR'S OFFICE:
MICHIGAN SQUARE BUILDING CHICAGO, ILLINOIS ★ WASHINGTON SERVICE OFFICE:
1003 K STREET, NW WASHINGTON, D. C.

Natal Base

(*Continued from page 86*)

Allied occupation of North Africa and lessening of the menace from French-owned Dakar by the pro-allied declaration of the Dakar government have minimized the danger of invasion of the Americas through the Natal region, in the opinion of military leaders.

As a point of offensive operations, however, Natal has taken on tremendous importance since the trickle of planes flying eastward became a steady flow.

The U. S. Army ferry command took the first planes across from Natal to Africa long before the United States got into this war. Then the American Government got the Brazilian government's permission for Pan American Airways to bring planes from the United States and ferry them across to Africa at Natal. The setup was called Pan American Air Ferries.

United States production then was small and most of the ships were going to England anyway; so only a few were taken across the South Atlantic route.

With American production stepped up after Pearl Harbor, American bombers reaching the British Isles in large numbers and British output going on at a steady pace, more craft could be sent to the African and Asian fronts.

When the U.S. Army revised the ferry organization, the South Atlantic Wing of the Army Air Transport Command was created. Pan American Air Ferries was in a sense incorporated into the Army operation. Transcontinental and Western Air, and Eastern Air Lines, also came into the South Atlantic ferry movement, under Army control.

Now those companies continue to fly cargo ships but under Army orders. PAA, TWA and EAL provide the personnel, but the men go and come in the ships assigned to them and on schedules set by the Army.

Heading the group was Lieut. Col. J. V. Dallin, of Philadelphia, Pa. His right-hand man was Maj. Robert T. Barton, Jr., of Richmond, Va.

Brig. Gen. Robert L. Walsh heads the South Atlantic Wing of the Air Transport Command, pulling the strings that keep the bombers and cargo ships moving from Puerto Rico to Africa.

General Walsh had his headquarters until recently at the Georgetown, British Guiana, field which, under the Anglo-American destroyer deal, became U.S. territory for 99 years. Walsh has now shifted his wing headquarters to Natal.

Parnamarim Field, outside Natal, was once just an average airport for Italian, German and French commercial planes crossing occasionally between Brazil and Africa, and for Pan American Airways coastal planes.

Today there are no French or German planes at Parnamarim and the only Italian craft is a big white transport ship taken over from the Lati Airline.

Along one whole side of the field are U.S. Army barracks and buildings that make up an Army post. Some of the men still sleep in tents, as they have flowed in more rapidly than structures could go up.

On the other side are buildings of the Brazilian air force. As in Great Britain, the Brazilian air force is separate from the army and navy.

In a glass-walled radio control tower, reached by climbing two vertical ladders, an American and a Brazilian are always on guard, to control movements of planes.

How many men are stationed at Parnamarim to keep the planes moving across, and how many planes are going over per month, are military secrets. But they are many. Flyers and planes that were in Natal one day were attacking Japanese armies in China and Burma and German and Italian forces in North Africa a few days later.

Some of the men go to the fronts in the planes they will fight in. Some go in transports and will find their planes when they get there. Some are not flyers but technicians, mechanics, or repairmen. Others are ferry pilots, who will be back in a couple of days when they pass their cargo of men and freight to other hands in Africa.

Sometimes passengers are prominent public figures who have to get somewhere in a hurry. Madame Chiang Kai-shek rode a ferry plane from Africa through Natal on her visit to the United States. Wendell Willkie flew eastward from Natal to get to Russia and China on his globe-circling journey. President Roosevelt stopped at Natal on his way back from Africa.

The Brazilian armed forces are charged with the defense of Parnamarim Field, just as of all other Brazilian territory. Many Brazilian troops are stationed in the area. Antiaircraft guns—some German, some French, some American—have been set up at strategic points. The Brazilian air force has many of its best combat planes in the region. There is a big Brazilian naval base which also is headquarters for the U.S. South Atlantic Fleet, and a smaller Brazilian naval base is located at Natal.

Through the freight warehouse passes everything from sewing kits to tank parts. Often the planes bring a full load from the United States, which means there is no loading at Natal. But the men have to be ready for the empty planes, at any hour. They always have a stock of Brazilian products in the warehouse, to put onto any U.S.-bound planes that aren't full.

Natal is a sleepy little town that has come alive since the Army moved in on Parnamarim Field. Much money has come in, and stores are thriving. The principal hotel, the Grande, is jammed.

The Air Transport Command staff house in Natal is a residence the Army has taken over and uses as a stopover place for ferry pilots from commercial airlines. Pan American Airways has its own house.

END

ARE YOU "FLYING BLIND"?

• Lack of training is a "fog" that has caused thousands of human "crack-ups." It is also a hindrance to America's war effort—for only the *trained man* can man a key position on the industrial battle-front!

• Why not get the sound training that will fit you for a responsible position in your chosen field? The International Correspondence Schools offer home-study courses in more than 400 business and industrial subjects, prepared by practical experts and kept abreast of modern developments. Among former I. C. S. students are the president of a great airline and many other leaders.

• For complete information and free booklet, mark and mail this coupon.

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 5843-E, SCRANTON, PENNA.

Explain fully about your course marked X:

☐ AIR PILOT
☐ AVIATION MECHANIC
☐ AIRPLANE MAINTENANCE
☐ AVIATION ENGINES
☐ AVIATOR
☐ AIRPLANE DRAFTING
☐ BLUEPRINT READING
☐ ELECTRIC WELDING
☐ FUNDAMENTALS OF AERONAUTICAL ENGINEERING
☐ SHEET METAL WORK

TECHNICAL AND INDUSTRIAL COURSES

☐ Air Brake
☐ Air Conditioning
☐ Airplane Drafting
☐ Architectural Drafting
☐ Architecture ☐ Boilermaking
☐ Auto Engine Tune-up
☐ Auto Technician ☐ Aviation
☐ Bridge Engineering
☐ Building Estimating
☐ Chemistry ☐ Coal Mining
☐ Civil Engineering
☐ Concrete Engineering
☐ Contracting and Building
☐ Cotton Manufacturing
☐ Diesel Engines
☐ Electrical Drafting
☐ Electrical Engineering
☐ Electrical Maintenance
☐ Foundryman ☐ Heating
☐ Heat Treatment of Metals
☐ Highway Engineering
☐ House Planning ☐ Machinist
☐ Industrial Metallurgy
☐ Locomotive Engineer
☐ Managing Men at Work
☐ Marine Engines
☐ Mechanical Drafting
☐ Mechanical Engineering
☐ Navigation
☐ Patternmaking ☐ Plumbing
☐ Practical Telephony
☐ Public Works Engineering
☐ Radio Operating
☐ Radio Servicing
☐ R. R. Engineering
☐ R. R. Section Foreman
☐ R. R. Signalman
☐ Reading Blueprints
☐ Refrigeration
☐ Sheet Metal Work
☐ Ship Drafting
☐ Shipfitting
☐ Shop Practice
☐ Steam Electric
☐ Steam Engines
☐ Structural Drafting
☐ Structural Engineering
☐ Surveying and Mapping
☐ Telegraph Engineering
☐ Textile Designing
☐ Welding, Electric and Gas
☐ Woolen Manufacturing

Name..... Age.....
Address.....
City..... State.....
Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

Order THIS EXCITING PICTORIAL SOUVENIR Now!

32 PAGES CRAMMED FULL OF THRILLING ILLUSTRATIONS OF SHIPS AND PLANES SHOWING OUR HEROIC NAVY IN ACTION . . . ON THE SEVEN SEAS

A SOUVENIR YOU'LL TREASURE FOREVER

INCLUDED AT NO EXTRA COST A COMPLETE SET OF 12 - 8½x11 BEAUTIFUL ILLUSTRATIONS OF FIGHTING NAVY PLANES

All For $1.00

AN IDEAL GIFT FOR A BOY IN THE SERVICE . . . AND A SWELL SOUVENIR FOR THE FOLKS AT HOME

M. B. LIBMAN CO., Dept. F. N.
1240 SO. MAIN ST. LOS ANGELES, CALIF.

254 pages of expert

MEDICAL HELP

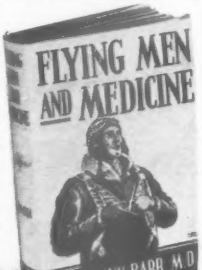
for airmen, students, and aviation doctors

THIS new book about the effects of flying on the human body, by a noted doctor who has been a flight instructor, gives the facts every flyer should know about:

1. **PHYSICAL TESTS**—How they work, what they accomplish, and what you yourself can do to pass them.

2. **THE EFFECTS** of high-speed, high-altitude flight on *Eyes* and *Ears*, and the *Nervous, Digestive, Circulatory*, and *Respiratory Systems* of the body.

3. **HOW TO KEEP FIT** for active flying by proper diet, exercise, and rest . . . How to overcome fear, nerve fatigue, build bodily reserves . . . Things to do if you are taken sick while flying, etc.



LIKE an experienced flight surgeon on instant call, this book rounds out your training, protects your health. Profusely illustrated with drawings and diagrams.

FLYING MEN AND MEDICINE By E. OSMUN BARR, M.D.

Illustrated, $2.50, at all bookstores, or
Funk & Wagnalls Co., Dept. 562, 354 4th Ave., N. Y.

The WAMS

(*Continued from page 39*)

was the first WAM, Audrey Kennedy, who came to work with the company last summer as a radium dial painter after giving up (for the duration) her career as an artist.

Just 21 and the winner of five art scholarships, Miss Kennedy decided to do her part for the war effort by sitting at a glass-enclosed case in the TWA instrument rooms, radium-treating the 50 dials on every plane panel so that the numerals and readings will be visible to crew members when cockpit lights are out. Jacqueline Pendergraft, previously a commercial art major, is doing the same kind of work.

At an adjoining table, Mrs. Myrle Schneider repairs gauges and flight analyzers. Her job is an intricate one, since the tiny needle of the analyzer tracing its tale on a small graph must be in exact alignment to operate perfectly.

Besides doing overhaul on the different, complicated units, the WAMS are learning to install the instruments in the airplanes.

A real man's job—engine overhaul—is being done by the WAMS in G. F. Van Skike's department.

"Takes training—but that's what they are getting!" he says. "We're teaching our girls to work on the Magnaflux machine, the carburetors, to fit piston rings and face valves, to inspect engine parts and build power sections, and to work on the final assembly line, installing cylinders.

"Some of the girls are even taking their places with the lead engine mechanics on the test stands, learning to make instrument readings and observing operation of the engines."

Of course, a few of the duties in an airline shop are closely connected with a woman's normal routine, such as housekeeping and sewing, scrubbing and decorating. In at least two departments, she has had no new tricks to learn, and instead is teaching her male co-workers a thing or two!

"Women may completely take over the fabric upholstery department soon," declares Wilson. "Their interior decorating is above criticism."

And TWA's big Douglas DC-3's are taking off these days from the Kansas City terminal with a brighter gleam than ever before on their fuselage and wings. Energetic WAMS, with buckets and mops, are responsible.

"At first we thought the outsides of those big transports would be too much for them," laughs Wilson, "but they thought that anyone who could wash the family car could make a plane shine—and they do it!"

One position new to women, however, was work in the propeller department. Yet today five of William Mitchell's 25 employees in that section are WAMS.

"They're doing varied jobs, and doing them well," declares Mitchell. "One is an assistant in the governor overhaul division—Mrs. Dwan Winans, whose husband is also an aircraft worker, has a natural aptitude for mechanics. With her 11-year-old son, she used to keep the household equipment at home in working order and admits she even overhauled a Model T Ford!

Another is making dimensional checks on propeller blades. "This duty involves reading such precision instruments as vernier calipers and micrometers."

Two others are employed on hub inspection. One, Mrs. Hildred "Bill" Ogden, used to be a beauty operator. "But before that," she claims, "I was a mechanic—and I still prefer grease to cosmetics."

A fifth is installing blade de-icers, "which consists of applying rubber 'shoes' to the prop blades," explains the foreman, "and the worker must know how to handle cement."

The last TWA shop division to accept the WAMS, the sheet metal department, now has 10 women among its 180 regular employees. R. W. Lichtenberger finds them capable at riveting, fitting and forming metal sheets, making tubing clamps, working the carburetor air scoops and doing all the general metal work applied to aircraft overhaul.

Though there has been more previous training among the WAM employees here than in the other divisions, experience remains the vital factor, and they "get that while they're on the job."

Mrs. Colletta Geier does filing and metal cutting of materials, and most of the sheet metal women workers are in a similar type of work.

"Our foremost woman, Mary Payne, however," says foreman Lichtenberger, "is doing what might be called experimental work, as she is on a specialized assignment. Out on the main floor in the hangar, surrounded by dozens of men workers, she is making special installations for navigation training, on compasses. And she's doing a grand piece of work."

Miss Payne had seven months' experience in a bomber plant before joining the WAMS.

Perhaps the opinion of Lichtenberger is more or less typical of all the foremen in the TWA shops.

"Every day we are losing valuable skilled men to the combat service. Although less than nine per cent of our department's workers now are women, it is conceivable that eventually 50 per cent may be of the so-called 'weaker sex.' And we might even assume that a greater percentage than that may be needed if the war continues over a period of years."

The whole point is that when one source of supply of available workers is exhausted, another must be tapped—and quickly.

And the women tapped for the overall-jobs once exclusively men's are winning their "letters"—including the WAMS!

END

Recognition Hints

(*Continued from page 60*)

dealt with first will be still further reduced. For instance, in the British Isles, mostly German multi-engined types will be met. In the Middle East, both German and Italian types will be found, while in the Far East it will be essential to concentrate first upon Japanese aircraft.

Whichever area we have to consider, not more than 20 enemy types are likely to be in that area. After taking into consideration the disposition of the enemy forces and the range of their aircraft, and a decision has been made upon the actual types we may meet, then all our attention should be given to those few until we are able to recognize them in any position.

After making sure of these, our next step should be to consider friendly aircraft operating in the area concerned which may be confused with enemy types, and after these, other types in the same area. By the time this stage has been reached (if study has been careful and concentrated) there will be little danger of mistaking friend for foe or vice versa. Therefore, a system which enables you to be sure about the enemy you are liable to meet immediately, enables you to proceed to learn enemy types which may be encountered in other areas until a stage is reached where all enemy types can be easily identified.

Then a similar sequence should be followed with the friendly types, always paying particular attention to those aircraft which are similar to enemy types such as the *Blenheim* and Junkers Ju-88, the *Beaufighter* and Messerschmitt Me-210, the *Lightning* and the Focke-Wulf Fw-189, the Douglas DC-3 and the Mitsubishi Me-20, and the *Mustang* and the Heinkel He-113.

After we have divided our aircraft into classes and, in accordance with the area in which we are operating or expect to operate, have decided which class must be given priority, then the question arises as to the best method to fix in our minds the appearance and shape of the aircraft.

Some method of study must be arranged which allows the student of aircraft recognition to have continued and concentrated exercise until the knowledge of what the aircraft look like is firmly fixed in his mind.

When the impression is retained, the mind will automatically respond to the various aircraft shapes and with the additional knowledge of details such as position of wing (high, mid or low), radial or in-line engines, shape of fuselage, shape of tail unit, etc., it will be found that confidence is sure and recognition is easy.

"Automatic recognition" is the automatic response of the mind to a given impression. Whenever we receive an impression through any of our senses it is conveyed to the mind as a nervous impulse. If the impression is strong enough or repeated often enough, it is retained, enabling us to recognize various things for what they are. In this way we quickly recognize thousands of objects, and so we know a chair, a tree, a house, a hill, a horse, a flower, etc., the moment we see them without having to study any details. We probably know 500-600 people, and if we put ourselves to the test we shall find that we recognize them by their general appearance, and not by any special characteristic—in fact we shall find we do not know the color of the hair, eyes, shape of head, nose, etc., of any but an intimate few of all the people we know.

Commence your study of the aircraft you wish to know by having photographs and silhouettes of each. [Each issue of FLYING features a "FOR IDENTIFICATION" department.—Ed.] When you have a few moments to spare, study the photographs and exercise your mind—send the impression of what the aircraft looks like again and again to the brain until you find it remains. You can always tell when the impression has been fixed, for without reference to a photograph or silhouette you will find you are easily able to create a mental picture of any of the aircraft you have learned to know.

Remember the exercise is to allow the eye to photograph the shape, in order that the impression can be passed to the brain. It does not matter much whether silhouettes, photographs, models or films are used, so long as the correct appearance of the aircraft is constantly photographed by the eye.

Automatic recognition or spontaneous

Here at this LINCOLN GOVERNMENT APPROVED SCHOOL, men of all ages are preparing themselves for Careers in Aviation. Draft age men are taking aircraft Mechanics and Engineering training in order to qualify themselves for assignment to duty in the Army and Navy Air Services

Family men with dependents and unclassified men are preparing for immediate ESSENTIAL employment with the great Airplane Factories . . . with the Airlines and at Airports. As fast as we can train them, these Lincoln Graduates are stepping into fine, good-pay positions where earnings frequently run as high as $80 and $100 per week. START TRAINING NOW AT LINCOLN. 7 basic courses offered. Choose the course that interests YOU most . . . then MAIL COUPON TODAY for complete information.

Choose One of These 7 Lincoln Courses Send for Information

- Aeronautical Engineering
- Government Approved Airplane and Engine Mechanics
- Aircraft Inspector Course
- Airplane Assembly Mechanics Course
- Airplane Drafting and Detail Design Course
- Aircraft Production Mechanics Course
- Aircraft Welder's Course.

Mail Coupon Today. Specify which of these courses you choose. Complete information will be mailed you.

LINCOLN AERONAUTICAL INSTITUTE
316 Aircraft Building, Lincoln, Nebraska

SEND FOR FULL INFORMATION TODAY

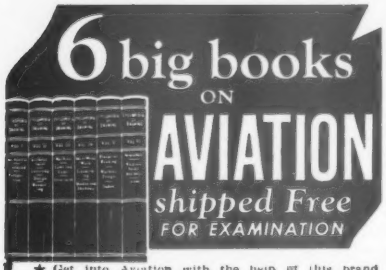
Lincoln Aeronautical Institute,
316 Aircraft Building, Lincoln, Nebraska
I'd like to prepare myself for essential employment in Aviation. Please send me information about your.....Course.
(Choose a course from the 7 courses listed above)

Name.....

Address.....

City.....State.....

LINCOLN GIVES YOU WHAT YOU NEED TO SUCCEED



6 big books ON AVIATION shipped Free FOR EXAMINATION

★ Get into Aviation with the help of this brand new cyclopedia just off the press. It is the most complete, most up-to-date set of books on this subject we have ever published. Aerodynamics, Soaring, Parachutes, Propellers, Ignition, Aircraft engines, Blueprint reading, Welding, Weather maps, Aerial photography, Air instruments, and hundreds of other subjects, all well covered.

for Beginners or Experts

Every man interested in flying, whether amateur or expert, should have these books. Written by a group of well-known experts in simple language so that anyone can understand them. Quiz questions and answers help to make this a complete reading course in Aviation. National Defense has opened up tremendous opportunities in this field. It is the fastest growing industry today with hundreds of opportunities for good jobs at big pay. Send the coupon for free examination. The complete set will be sent to you promptly.

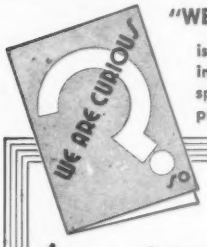
Consulting Service Included

A full year's consulting privilege with our engineers now given without extra charge to every buyer of these books.

AMERICAN TECHNICAL SOCIETY
Dept. HA16 Drexel at 58 St., Chicago, Ill.

American Technical Society, Dept. HA16
Vocational Publishers since 1898
Drexel at 58 St., Chicago, Ill.
Send for 10 days' trial. BRAND NEW 6 volume set, Aviation. I will pay the delivery charges only. If I wish I may return books in ten days and owe you nothing, but if I decide to keep them I will send $2.00 after ten days, then only $3.00 a month until $19.80, the total price, is paid. Send BRAND NEW edition which includes Aviation Blueprint Reading and free consulting service for one year.

Name .....
Address .....
City ..... State .....
Please attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference.



"WE ARE CURIOUS" is a questionnaire placed in Roosevelt rooms. Responses enable us to improve our service.

"I like the Roosevelt for its friendly services without any pretentiousness —"

is the answer we get most often

ROOMS WITH BATH FROM $4.50

25% Reduction on Room Rates to Members of the Armed Forces.

HOTEL ROOSEVELT

MADISON AVE. AT 45th ST., NEW YORK
BERNAM G. HINES, *Managing Director*
Direct Entrance from Grand Central Terminal

recognition is not free from snags. The response of the mind to a general appearance goes a long way towards recognition, but there is always a danger of aircraft being seen in one of those difficult oblique positions, which are so many and varied as to be impossible to fix in the mind. Further, when the mind responds to a general appearance it does not allow for similarities. We all have probably experienced the reaction of the mind to some person who we were sure we knew, but upon reflection we felt we were mistaken and so we looked for a prominent feature of that person, and assured ourselves one way or the other if our first response was right.

This occurs upon many occasions with aircraft, and when this difficulty is taken into consideration along with the many varied positions an aircraft may be seen in, then it is obvious that in addition to our knowledge of the general appearance of the aircraft, we also need to look at the various components. Now it is little use trying to look at these components in any particular order such as wing, engines, fuselage, tail, nor is it worthwhile attempting to learn every little detail about each aircraft. It will be found in practice that many of these details cannot be seen nor is there time to consider first the wing, then the engine, and so on. Each aircraft has one or two distinctive features.

And so the elliptical wings of the *Spitfire*, the large span of the tailplane of the Messerschmitt Me-110, the high fin and rudder of the *Wellington*, the slimness of the Dornier Do-17, the flat top of the fin and rudder of many of the German aircraft such as the Junkers Ju-52, Heinkel He-115, the Junkers Ju-86 and -87; the dihedral on the tailplane of the *Boston* and several of the American flying boats, the engine in tandem on the Dornier Do-18 and 26, the long engine of the Junkers Ju-88, the unbroken dorsal line and shallow steps of the Kiwanishi T-97, navy flying boat; the low aspect ratio, large tailplane and conspicuous fuselage taper of the Mitsubishi T-96, heavy bomber; and the even taper on the fuselage and triangular fin and rudder shape of the Zero navy fighter. These are all features which render considerable assistance in identification, and which can be learned in the same way as the general appearance of the aircraft.

Don't be satisfied until you can not only picture the aircraft, but also any important components.

END

Report from Washington

(*Continued from page 42*)

and major air carriers were just beginning to fly four-engined equipment when the war intervened. Although our safety regulations, in general, require the use of multi-engined equipment, two pilots and two-way radio in passenger service, it appears appropriate to inquire as to whether single-engined aircraft operated by one pilot and without complete accessories could be used with safety in providing limited local passenger service to small communities. It should not be necessary to take the position that small communities shall have Pullman plane accommodations or none at all.

The single-engined Vultee, in which Maj. (now Major General) James H. Doolittle made a 12-hour transcontinental record in 1935, was used for some time by one of our major airlines.

In the United States we have not specialized in developing a short-range transport aircraft because we were first concerned with developing the long trunk line air routes that conquered the great distances of our continent. However, the time has now come to make plans for the extension of air service to the nation as a whole including provision for local service to small communities.

Plans must be prepared and completed now so that post-war expansion of our domestic air transportation may be orderly and rapid. In a desire to be forehanded in this matter, the CAB by order dated March 22, 1943, instituted an investigation of "local-feeder-pick-up" air service which will result in a study of the methods and feasibility of providing air service to the hundreds of small communities which have insufficient traffic potential to support the conventional types of operation presently conducted by the scheduled air carriers or which lack airports of sufficient size for the heavier types of transport aircraft. By its order the Board expects to give leaders in American aviation an opportunity to come together and contribute their experience to a co-ordinated planning for this local development. It is expected that the CAB's investigation will open such questions as the extent to which air service would furnish smaller communities with a useful and economically justifiable service, methods of operation, types of flight equipment necessary, airports and other facilities required, the amount of financial support by the Government which is justified for such service, proper means of assuring that such service shall maintain its local-service character, and, in general conditions upon which authorizations may be granted.

One of the most important factors in such development after the war will be the tremendous pool of military trained aviation personnel available. It is our duty to plan now for this development. With the co-operation of the entire aviation industry we then will have materially contributed to and carried out the provisions of the Civil Aeronautics Act which charges the Board with the "encouragement and development of an air transportation system properly adapted to the present and future needs of the foreign and domestic commerce of the United States, of the Postal Service, and of the national defense."

L. WELCH POGUE
Washington, D. C.

END

Wash Ride

(*Continued from page* 88)

A cadet suddenly tapped me on the shoulder.

"Say fellow, Lieutenant Adams is waiting down by the end of the hangar. He's mighty irritable because you weren't there to meet the plane."

I was halfway the length of the ramp before he had finished talking. My parachute bumped the back of my legs with each step.

There he was. Impatiently tapping the fuselage with his finger tips. Nervously I climbed into the cockpi', started the engine, and waited for the word to taxi out — a signal always given me when riding with my civilian instructor.

"Shall we just sit this one out?"

About jumping out of the plane, I jammed the throttle wide open.

"Please mister, if you don't mind, just wait until we reach the runway before taking off."

Complete paralysis wasn't far off at this point. Somehow the airplane managed to get into the air. I was breathing more freely now. Point one for me. Then came his rasping words.

"For the money I get, I do this."

Just sour, I growled to myself. That was a good take-off.

An officer, when giving a check ride, doesn't like to be taken very far from the airport in the process. It is just a waste of time and slows up his schedule. This fact had been told to me again and again by the boys in the know, but I was still concentrating on my wonderful take-off.

"Making a cross-country trip, mister?"

Looking back, the airport was miles away. Point one for the lieutenant. I settled down into my seat. By golly, I'd give him a ride that he would never forget.

He pointed with his finger. "Do me a two-turn spin to the right and come out of it with the plane lined up parallel to the road down there."

I was in a mental blackout by this time. The only thing of which I could be certain was that I hadn't been doing too well. There was no doubt in anyone's mind about that point.

Pulling the plane up into a stall I kicked in the left rudder. Into the spin we went. Whoops! He had said to the right. Oh well! No use in being narrow about these things.

Recovering, I found the plane in perfect alignment with the road. A feat I had never been able to accomplish in practice. My ego swelled. My chest expanded. Then came the puncture.

"The spin was o.k. mister. Too bad you didn't have some red paint, though."

"What for?" I innocently shouted.

"To stick your fingers in; so you could tell which is your right hand."

That joker. That clown. He looked so pleased with himself at this remark that I'll bet he has used it on every ride since.

"Do me some lazy eights."

Now I'd show him, I thought. Eights were my specialty. Up, over and down went the nose of the airplane. I really was grooving them. He would have to pass me now. I should have known better by this time however. There was a roar in my earphones.

"Whatever you are doing might be perfect as far as I know, but when are you going to start those lazy eights?"

Oh! Insult. Insult. I began to wonder what kind of a job I could get back home. Maybe a soda squirt. The fancy maneuvers that I had learned could probably be more ably performed with scoops of ice cream as far as I was concerned.

"Forced landing!"

He had pulled the throttle to closed position and was expecting me to pick out the best available field in which to make a simulated landing. This is a good test of a cadet's judgment and coolness in emergencies. Instructors rate the maneuver as one of the most important in determining flying ability.

Estimating wind direction and picking out a field, I started on my approach. We were gliding in a large circle and losing altitude rapidly. The way I handled the plane now would make or break me as a pilot. The very pores of my brain were sweating at the thought—sweating being about the only activity this foresaid brain was engaged in then.

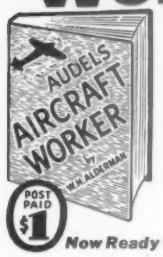
"Ah!" I calculated, "This will be good." Wings dipped into the field. Oh sad, sad cadet. My chosen ground was overflowing with grazing sheep. The plane would be torn to bits if the landing were completed. The lieutenant shook the stick meaning that he had the controls. Then—

"Like mutton, do you?"

This was the end. Absolutely. Back

Snap into it Mister!
HERE'S THE RIGHT WAY TO
WIN YOUR
WINGS
DO NOT CHOKE THE STICK
A PRACTICAL TEXT FOR THE PRIMARY STUDENT
Student Pilot Handbook
By JACK HUNT and RAY FAHRINGER
Foreword by COREY FORD & ALASTAIR MACBAIN
$2.50
Break out a copy of—
STUDENT PILOT HANDBOOK
STUDENT PILOT HANDBOOK gives you the Do's and Don'ts about
GROUND SCHOOL
SIMPLE AERODYNAMICS
FLYING REGULATIONS
FLYING BY FEEL
SOLO SIGNALS
CLIMBS, GLIDES, TURNS
STALLS, SPINS, ACROBATICS
NORMAL & FORCED LANDINGS
NORMAL & CROSSWIND TAKEOFFS
SIDE, OVERHEAD & CIRCULAR APPROACH
WINGOVERS, LOOPS & ROLLS
and many other important flying facts you must know.
by JACK HUNT and RAY FAHRINGER
with hundreds of illustrations by Ray Fahringer
From takeoff to three-point landing, every rule of flying is carefully explained in straight-from-the-shoulder, flying-instructor language, the kind everyone can understand with hundreds of detailed drawings, diagrams and cartoons that graphically illustrate every important point.
Both authors are old-line flight instructors who won their wings the hard way and whose log-books show thousands of hours of flying under all conditions. Their book was developed right on the flight line of a famous flying school and they're now in the Air Corps.
This STUDENT PILOT HANDBOOK will meet your need for a ready reference to all the problems and questions which will come up in your training and will prove a constant guide, companion and 'dutch uncle' when you need it. So here's luck on that first solo flight and many more to come!
FULL MONEY- BACK GUARANTEE
MAIL THIS COUPON NOW!
BOOKS, INC., Dep't. I
1140 Broadway, N. Y. C.
☐ I enclose $2.50
☐ Send C.O.D.
Please rush my copy of STUDENT PILOT HANDBOOK
If not satisfied, book will be returned in ten days and my money refunded.
NAME.....
ADDRESS.....
CITY.....
GRASP IT FIRMLY BUT LIGHTLY AND RELAX!

AUDELS
AIRCRAFT
WORKER



Now Ready

Answers Your Questions. Every Mechanic & Aircraft Worker should own this useful book, containing clear, concise, practical information, pointers, facts and figures relating to correct modern shop practice.

9 Sections—240 Pages —Fully Illustrated —Covering

1—Aircraft Materials, Terms, Parts. 2—Blueprints, Working Drawings. 3—Mathematics, How to Figure. 4—Layout and Bending. 5—Tools and Machines. 6—Riveting, Spot Welding and Hints. 7—Fabrication, Blocking, Angles, etc. 8—Assembly, Fuselage, Wing & Final—How to Use Tools. 9—Tables & Data, Symbols, Army & Navy Specifications, etc.

Money back if not O.K. To get this assistance for yourself mail coupon today.

ASK TO SEE IT TODAY

AUDEL, Publishers, 49 W. 23rd St., N.Y.

Mail AUDELS AIRCRAFT WORKER (Price $1). If satisfactory, I will remit $1 on its safe arrival, otherwise I will return the book.

Name _____

Address _____

Occupation _____

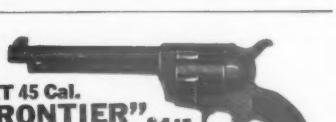
Employed by _____ FLY

GENERAL H. H.
ARNOLD
and MAJOR GENERAL IRA C.
EAKER
are the authors of
THIS FLYING GAME

THOUSANDS of boys and men have learned about flying from this book. The whole story of flying men and machines by our famous air generals. "As authentic as the chatter of a machine gun, as thrilling as a power dive." — *Chattanooga Times*. 300 pages, 149 illustrations.

Latest revised edition, $3.00

At bookstores, or
Funk & Wagnalls Co., 354 - 4th Ave., N. Y.



COLT 45 Cal. "FRONTIER" MODEL $1.45

Wood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit. 4¾" barrel.	$1.45
COLT 45 Cal. "FRONTIER" model kit. 5½" barrel.	1.55
COLT 45 Cal. "FRONTIER" model kit. 7" barrel.	1.70
COLT 45 Cal. Automatic Pistol kit.	1.00
Full scale Thompson Sub Machine Gun model kit.	3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel.	.75
LUGER Auto. Pistol with 4" machined barrel.	1.75
LUGER Auto. Pistol with 6" machined barrel.	1.90
COLT 25 Cal. Automatic Pistol kit.	.50

These beautiful kits are complete in every detail and made of the best wood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

GUN MODEL CO.
Dept. KB-6 2908 N. Nordica Ave. Chicago, Ill.

to the airport we went. He did the flying while I just sat. Knockout! That's what it was. I felt as though I had just finished 10 fast rounds with Joe Louis. Banking the airplane into the home grounds, he landed and taxied up to the line. We both got out.

"Mister," he said, "Do *you* believe that was a good ride?"

"No, sir." I was afraid to look him in the eye.

"Well, I think that it was so bad—" he said, "that I'd make you give me another one—only—"

I waited for the axe to fall.

"—only I'm too young to die."

At this, he hoisted his parachute over his shoulder and stomped off, still muttering to himself about the awful things he had to do in order to make a living.

Me? My face lit up in one glorious smile of joy. This was his method of telling me that I had passed the ride. I ran to the flight room to spread the news to the boys still waiting their turn.

"How was he to ride with? Easy! Nothing to it, boys."

END

Scrapped Veterans

(*Continued from page 41*)

and practically never washed during the cold and blustery Chicago winters. Then, again, approximately half of the squadron's planes must stand outside the hangar which is only large enough to house half the complement, come wind or high water.

At the beginning of the squadron's existence, it was impossible to have the planes re-covered and repainted to put them in flying shape as these jobs would take the urgently needed planes from classroom work. Now, however, as more and more planes are coming in, the torn fabric is being replaced and the craft made theoretically safe for flight. "Theoretically" is used advisedly because the new covering for the wings is not much better than cheesecloth, thereby saving first-line fabrics for other craft which will actually be flown.

This cheap fabric, while fine for training, does not stand up well under the abuse of weather and constant handling. When parked outside in the cold, the fabric and paint will crack and split, leaving holes in wings and fuselage.

Another reason many of the planes have a threadbare appearance is because machinist students clamber over them daily, removing and replacing assemblies. Motors are removed from some planes as often as twice a week.

The debutantes are better looking and seem in superior shape when compared with the older planes. Occasional greasy hand prints might be seen around engine cowls and there are scratches on metal surfaces. But even after countless tear-downs by men learning a new trade, they still look grim and efficient.

Oldest of the collection are the O3U's, observation planes built along in 1930. Following their service with the Fleet, the planes were transferred to cadet centers and were used as trainers. Two-place biplanes, they have swept-back wings and landing gear spreader bars apparently heavy enough to carry a truck. The fore cockpits are conventional, but aft, the cockpits are shaped like milk bottles and are designed to take Lewis .30 caliber gun mounts.

Little Grumman F3F-3's and F2F-1's —the immediate predecessors of today's *Wildcats*—are scattered about the station in profusion. Single-place biplanes, they are squat-bellied and have approximately 750 h.p. engines. According to Lieut. Guy Conrath, chief of the metalsmith's branch of Squadron Operations, many planes of this type were sold at the beginning of the World War to England and France as among the best in U. S. aircraft. Some were flown at Pearl Harbor and others are still stationed at advanced cadet flying fields.

Two-place Grumman SF's and FF's are also kept for machinist student instruction. Observation and two-place fighters, these planes have been "surveyed" and are considered obsolete. War-accelerated design improvements have made them old in a few years.

A third type of Grumman is the JF-1 amphibian. Designed as utility planes, some are still seeing service carrying light cargo and personnel. As with most of the planes on the pier, the original squadron insignia has been painted off but, according to the men, this type of plane often carried a painted diaper and safety pin as an unit marking. Their pilots had the unofficial unit motto, "We carry—everything."

Recently brought in is a SBU-2, a 1936 version of the dive bomber. Bomb racks had been removed, but the carrier arresting gear hook was still in place.

A weather-beaten old Martin P3M-1 has been standing outside the hangar since the day it arrived for it would take up too much room in the crowded shelter. Of all the planes at the station, this one is the most obviously non-flightworthy. Her high wing has been buffeted by winds all winter; inside, aluminum deck plates have been removed by students inspecting control cables; and the tires seem to be holding all the load possible. It is doubtful if these tubes and casings would ever again stand the shock of a landing. The hatch on top of the hull is even sticky. However, with all its faults, the P3M-1's controls are in working order and the twin engines will turn over—all that is necessary.

Several Curtiss *Falcon* (SNC) trainers are at the station as the result of training crack-ups and runaways on the tarmac. These planes' dented fuselages provide classwork for the metalworker.

One Grumman SF was being torn down and scrapped. Salvage crews were removing the wings, engine and all sections of the fuselage. The plane had seen flight service and had been used in Squadron Operations, but after countless tear-downs and re-assemblies, her engine-mount screws and bolts were too

worn and other sections were just about useless.

"There are four flights of 20 planes each in Squadron Operations," said Lieutenant Ball. "When replacements come in, the planes in the worst condition are scrapped. Engines go to the engine shops, props to the propeller shops and parts such as tubing and other little items are kept in bins until they are needed as replacements."

Very little of an old Navy airplane is wasted. That night a truck was pulling out of the station piled high with scrap aluminum—all that was left of an old airplane.

END

London Survey

(*Continued from page 37*)

in the British aircraft industry has been able to prepare detailed designs for a transport plane. We may even now be too optimistic in assuming that the formation of a Transport Command must be followed by the issue by the Air Ministry of specifications for transport aircraft, but there is no doubt that, apart from bomber conversions, there can be no delivery of transport aircraft from the British industry for fully three years.

Were orders given at once to the British industry to begin work, the number of transports it could undertake to supply would be but a small fraction of the output of transports promised by the American industry in the current year. Great Britain is committed to the production of big bombers aind fighters. Its Aircraft industry is just approaching the peak of that production. Labor is now the limiting factor, as it is in Germany. No big diversion of production to transport types of aircraft can therefore be expected. No big diversion has been asked for by any of the critics who have agitated during the past year. What they have demanded is that air transport should not be neglected by the British or handed entirely to the United States.

When all the circumstances are examined, the probable need of American aircraft for the RAF Transport Command seems undeniable. The likelihood that some of the Lend-Lease transports will be supplied to British Overseas Airways for Transport Command work seems equally high. There will be an economy in operating types similar to those which already are being used by the U. S. Air Transport Command in Europe and Africa, because spares and service stores for them already are being laid down.

* * *

Other news which has become available lately in London is of the more detailed kind. An interesting disclosure about the de Havilland *Mosquito* is that it now is being used as a fighter on intruder patrols from Malta. In fighter form it is armed with four cannon of 20 mm. and with four machine guns of .303 caliber. With its high speed and relatively long range, the *Mosquito* should have an important future in this new form.

* * *

Some information concerning the Mes-

"The Best Pastime in the World"

writes J.F.W., Av. Pilot 2/c USNAS, Pensacola, Fla.

Read what he says: "Have been building Cleveland Models since I first started modelbuilding over 8 years ago. We lived at France Field in the Canal Zone then. Your Army models are the best in the world . . . now your Navy models surpass all. I am an Aircraft Recognition Instructor, and have found that building your models helped me infinitely. Knowledge of their construction helped me with my ratings Aviation Machinist Mate 2/c, and then gave me my best boost of all, both in recognition classes and structures . . . now I am an Aviation Pilot 2/c. I still build Cleveland Models, and find it the best pastime in the world."

CURTISS "HELLDIVER" Navy scout bomber, also dive bomber. Span, 25¼". C-D Master Kit SF-80 .. $3.50

Republic P-47 "THUNDERBOLT" The "Flying Battleship" with tremendous fire power. A speed of over 425 m.p.h. and a 40,000 foot ceiling. One of our greatest fighters. Span is 30¾". C-D Master Kit SF-81. $4.00

"BELL AIRACOBRA" The Swift flying "cannon-plane" that's doing great work in the Solomons and England. Span 25½". C-D Master Kit SF-76 ..... $3.00

North American "MUSTANG" P-51 A tough vicious fighter that is very much in today's news. 350 m.p.h. Span, 27 3/16". C-D Master Kit SF-91 ..... $3.00

Vought Sikorsky "CORSAIR" A Navy fighter in the 500 m.p.h. class. Span 30¾". C-D Master Kit SF-79.... $3.50

Lockheed "HUDSON" Bomber Used with terrific effect on the Japs in the Solomons. Used for bombing, fighting and reconnaissance. Called "Old Boomerang" by British, for it usually comes back. One of the most popular models in the whole C-D line. Big 49¾" span. C-D Master Kit SF-95..... $7.50

DOUGLAS SBD "DAUNTLESS" World's hardest hitting dive bomber. Used by U. S. Navy and Marines. Has scored heavily against the Japs in every Pacific engagement. Span 30⅝". C-D Master Kit SF-89.... $3.50

Curtiss P-40 Making history everywhere it takes to the air. Span 28½". Camouflage instructions included. C-D Master Kit SF-77 ... $3.00

They're "Tops" in Design, Engineering, and Realism.

Biggest $1.00 Plane in the U. S. 4-Ft. EAGLET

Lockheed P-38 "LIGHTNING" A deadly interceptor because of its amazing speed, high ceiling, and terrific diving power. C-D Master Kit SF-85 ..... $4.00

New, Redesigned Super CONDOR SOARER Big 7 ft. Span. More graceful lines, simpler construction. Soars for hours. Easier than ever to build. Kit VE-5019, only..... $1.00

NAZI JU-87B STUKA The dive bomber used so widely by the Nazi Germans all over Europe, at Crete and now in Africa. Span, 30¾". C-D "Master" Kit SF-84 ..... $3.50

ORDERING INSTRUCTIONS See your dealer first. If he can't supply you, send check or m.o. (cash at own risk). No C.O.D.'s. Postal restrictions now prohibit shipments to anyone outside U. S. (with the exception of Official Military orders) except to Canada and Mexico (to which 10% must be added). For service men still stationed in U.S.; restrictions prevent our shipping to A.P.O. or Fleet P.O. box numbers—so, use a local nearby address only! Special Delivery 25c extra (U.S. only). Ohio residents add 3% sales tax. All Kit contents and prices subject to change or cancellation without notice.

CLEVELAND MODEL & SUPPLY CO., INC., 4508C54 Lorain Ave., Cleveland, O.

"World's Largest Makers of Quality Model Aircraft—Since 1919"

Send for New #40 CATALOG

Features C-D War Models in thrilling action "shots" in various fighting fronts. Many others. No catalog ever before like it. Send 5c for your copy—none free.

CLEVELAND MODELS

"THE MODELS THE MEN IN THE AIR FORCES BUILD"

AERONAUTICAL ENGINEERING

DEGREE IN 27 MONTHS

Graduates employed by leading aircraft manufacturers in engineering and top positions. Qualify for present heavy demand at Indiana Tech. B.S. Degree in 27 months. Intensely specialized course of full engineering fundamentals including aerodynamics; airplane, seaplane and propeller design. Ultra-modern wind tunnel; precise and extensive equipment. Approved by CAA, both primary and secondary programs. Qualify educationally as cadet, Army and Navy Air Corps. Also complete degree courses—Chemical, Civil, Electrical, Mechanical, Radio Engineering in 27 months. Plenty of self-help opportunities in modern industrial city. Enter June, Sept., Dec., March.

INDIANA TECHNICAL COLLEGE

126 East Washington Blvd., Fort Wayne, Ind.

Short-Cut Mathematics

COMBINED WITH

Practical Mechanics Simplified

NEW 2-in-1 reading course! Now you can learn the speedy, simplified system of calculation used by draftsmen, engineers, accountants, "master minds" on the stage. Learn easy way to multiply 4 figures by 4 figures without using old-fashioned multiplication; add long columns of figures this lightning short-cut method. Learn horsepower, slide rule, micrometer, logarithms, wood measure, puzzles, etc., etc. Large illustrated volume complete with answers, only $1 postpaid. Satisfaction or refund. Amaze friends with your magic-like mental powers.

FREE Complete details ... mail coupon TODAY!

NELSON CO., 500 Sherman St., Dept. 305-F, Chicago

Please send free details about "Short-Cut Mathematics and Practical Mechanics Simplified." No obligation.

Name_____

Address_____

serschmitt Me-109G as a competitor of the *Spitfire* is also of interest in view of the putting into commission of the new German aircraft carrier *Graf Zeppelin*. The Me-109G has a pressure cabin and a ceiling of more than 40,000 feet. If the Germans should put that type in their aircraft carrier, the best the Fleet Air Arm would be able to set against it at present is the *Seafire* which is the equivalent of the *Spitfire V* and is armed with two cannon and four .303 machine guns.

* * *

A few facts which have an oblique bearing on the possibilities of the new Napier *Sabre* engine have been allowed to leak out nearly three years after the event. Up to now the fact that a special plane designed for an attempt on the world's speed record was finished in 1940, by Heston Aircraft Ltd., had been kept secret. That plane was fitted with the first of the *Sabres*. Unfortunately it crashed on its first test flight and therefore no evidence of its speed ever became available. Independent calculations suggested that it should have been capable of about 480 m.p.h. The crash was caused by engine trouble which compelled the test pilot to attempt to land after having made a half circuit of Heston after taking off. The plane stalled at about 20 feet from the ground, broke its back and has never been rebuilt.

Since those days a great deal of development work has been done on the *Sabre* and, during the past six months, the engine has had the benefit of extensive service trials in RAF squadrons equipped with the Hawker *Typhoon*. Some of those squadrons are now dealing with the Focke-Wulf Fw-190's which make sneak raids at sea level on coastal towns in south-east England. The success already won by the *Typhoons* warrant high hopes for the *Sabre* and the fast planes in which it is likely to be used.

END

Assault on Africa

(*Continued from page* 33)

read:

"0650—Land (Africa) visible ahead. Eighteen miles."

"0806—Submarine sighted on port quarter. Distance about 5,000 yards.

A carrier, to launch, must have a certain amount of wind over her flight deck. To have it, she must head up windward. The submarine had estimated the carrier's course and lain in wait.

The chaplain manned the ship's loud speaking system, giving a play-by-play report to the vast complement many decks down. "Submarine sighted," he announced, as calmly as if he was describing a ball game. "One of our bombers dropping depth charges."

"0812—Torpedo wake sighted. Made emergency left turn. Full speed ahead."

The submarine had the jump on the field. She fired once, then ducked for cover. Her torpedo flashed across the carrier's bow. "Here it comes," roared the chaplain, "but it's wide. Wide. Wide!!"

The carrier had wheeled, her bulkheads groaning under the strain, and was lumbering about like a distraught elephant. From off her catwalks came the thumping of short guns and the sporadic crashing of the huge five inchers.

"0816—Planes on starboard quarter and destroyer on starboard bow both dropping depth charges."

Overhead the torpedo planes levelled out and roared down to drop their loads. In came the cans, converging at top speed over the target area.

"0820—Destroyer reported torpedo wake approaching our starboard bow."

The chaplain's voice sounded ominously over the din of the starboard batteries. "Get ready. Here's another. It's close. Very close. No! No!! It misses."

"0824—SOC dropped depth charge. SBD's dropped depth charges. Destroyers dropped depth charges."

The planes were over the target area, releasing smoke bombs where the periscope feather had been visible and following up with 100-pounders. Then the destroyers moved in on their prey, dropping their charges methodically in widening patterns. Geysers of water churned upward as the bombs exploded fathoms down. Suddenly the sub broke water, her bow rearing upward, then slid slowly down and disappeared under the pointed wave crests.

"0832—Ship passing through oil slick two miles in length."

From the carrier bridge the lookout reported oil and bits of wreckage. Signal blinkers from the destroyers gave confirmation. "Destroyed," yelled the chaplain, "Submarine destroyed."

The carrier was far away by now, launching again as if nothing had happened. Submarine attacks became an increasingly dreaded routine during those hectic days as the Axis wolf packs concentrated in force during and after the "cease firing" order against the French was broadcast on November 11.

Assistant Secretary of the Navy for Air Artemus L. Gates had a word to say about it later on. "Carrier-based airplanes, covering the November landing operations on the west coast of North Africa, neutralized strong opposition which might otherwise have made this expedition an extremely costly affair." There was something he didn't say:

"Sometimes carrier duty can be downright exciting."

END

DON'T BE *OUTSIDE* LOOKING IN!

THE DOORS ARE OPEN TO YOUNG MEN

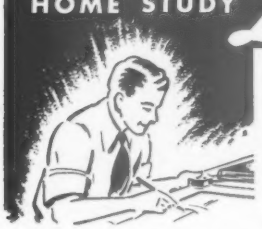
A REAL lifetime career is offered by Aviation. America is going to lead the world in peace-time Aviation. The tremendous growth will give unusual opportunities to young men who are prepared. Start training now—specialized experience will assure your future success.

Write for Free Folder.

35 WEEKS Gov't Approved MASTER MECHANICS
20 WEEKS Gov't Approved ENGINE MECHANICS
20 WEEKS Gov't Approved AIRPLANE MECHANICS
8 WEEKS ENGINE MECHANICS
8 WEEKS AIRCRAFT SHEET METAL

Atlantic AVIATION INSTITUTE INC.
61-65 PROSPECT ST. TRENTON, N. J.

HOME STUDY *Learn* AIRCRAFT DESIGN



Men desperately needed for aeronautical drafting and engineering. Get out of your routine job into a better one. Special training means more pay . . . and you can learn quickly with a Ryan Home Study Course in spare time. Courses prepared by aviation industry leaders easy to understand. Mail this coupon for free catalog with full information. No experience necessary.

FREE Mail Coupon Today for 24-Page Illustrated Catalog

RYAN AERONAUTICAL INSTITUTE
Home Study Affiliate of
Ryan School of Aeronautics
136 Lindbergh Field, San Diego, Calif.

Name .....
Address..... City..... State.....

The Library

(*Continued from page 85*)

of aerial photography by seeing a photograph taken in 1860 of Boston from the air. The rudimentary aircraft carrier that Prof. T. S. C. Lowe used on the Potomac River during the Civil War gives the United States the earliest ship-borne air observation craft. The earliest aeronautical society was suggested by Octave Chanute in 1893, at the time he and Dr. A. F. Zahm organized the International Aeronautical Conference held during the World's Fair at Chicago. At this meeting distinguished experimenters in the art gave papers forecasting the coming of mechanical flight. Mr. Milbank has explored the early attempts to make practical flying machines. The ornithopter and helicopter ideas in this country date back to the time of the Civil War.

Though this experimentation brought few useful results it was leading up to the work of the Wright brothers. As Mr. Milbank concludes, "Despite their confidence, however, the early pioneers of the air realized that time involving perhaps many years of patient endeavor might elapse before such direction of power could be made possible. Ingenuity, persistence and especially unselfish co-operation were recognized as fundamental to the solution. Inevitable though such a solution may have been, coming only a little after 10 years of comparatively concentrated effort and reached in the face of public ridicule, is in itself eloquent tribute to the pioneering spirit which made it possible. This spirit had blazed a trail of danger and discouragement toward the road of ultimate triumph."

MAJ. LESTER D. GARDNER
Executive vice president
Institute of the Aeronautical Sciences

END

Plastic Planes

(*Continued from page 36*)

and pressure. If you were confused by the words resin and rosin, rosin is one of the natural resins, like shellac, pitch, asphalt. Synthetic resins are used for the infusible type of product—the "plastic plane" for example; natural resins for fusible molded products.

Though manufacturers of plastic plywood airplanes were not originally interested in their being cheaper, processes are continually being accelerated. Wood is now in sight of mass production possibilities. For example, the "cooking" process described has been improved upon by using electrical resistance to heat the material. Fairchild is using high frequency radio transmission. In the ordinary steam chamber the heat would char the outside of a thick piece of material before the core had been properly "cooked." Radio transmission heats the material internally simultaneously, shortening the "cooking" period from hours to minutes. The way Fairchild does it the wood layers are subjected to a mechanical pressure of about 100 pounds per square inch while the whole mass is heated to about 275° F. With sufficient pressure it is possible to vary the density of the material to the point where the wood can actually be machined. Some makes of propellers are manufactured by this basic process.

END

COMBAT PLANES OF ALL NATIONS

64 Official Photos of WAR PLANES 50¢

U. S. ARMY & NAVY · BRITISH · RUSSIAN · GERMAN · JAPANESE · ITALIAN

Fighters! Dive Bombers! Torpedo Bombers! Paratroop Transports! Light and Heavy Bombers!

BEAUTIFUL REPRODUCTIONS 5¼ X 8⅛ READY FOR FRAMING

Send for your collection today!

SEND MONEY ORDER OR COIN TO BOX NO. 89, STATION O, N. Y. C.

(Write Name and Address Clearly)

Name _____

Address _____

When You Buy WAR BONDS You're Saving—Not Giving!

Be an AIRCRAFT INSTRUMENT TECHNICIAN TODAY
. . . and get ready for your after-the-war FUTURE

AS AN AIRCRAFT INSTRUMENT TECHNICIAN, you are needed NOW . . . *AND* TOMORROW! No matter what you're doing today . . . whether you're in the Army or Navy . . . in a war production plant . . . or in non-essential work . . . you can start now to prepare for your TOMORROW. If you haven't found your war job here's golden advice. If you're doing your bit you will nevertheless find this booklet helpful in planning your future, as well as improving your present opportunities. Remember, a man's judgment is only as good as his information. Read this advice from America's oldest, largest instrument school.

Send for this 24-page book TODAY

Contractors to U. S. Army Air Forces Technical Training Command

AMERICAN SCHOOL OF AIRCRAFT INSTRUMENTS
3903 San Fernando Road, Dept. F-6 Glendale, Calif.
Please send me your 24-page book on Aircraft Instrument Opportunities.

Name.....
Address.....
City..... State.....
Occupation..... Age..... F-6

Does Your Watch Keep Accurate Time?

Our fully equipped, modern watch repair department, which employs only expert mechanics, will accept the repairing of all types and makes of Military Watches, Chronographs, Chronometers, Stop-Watches, Repeaters, Complicated Timers, Water-proof, Regular and Pocket Watches, also all makes of Dial Indicators and Instruments.

All watches are checked with Western Union Naval Observatory Time and adjusted with scientific precision with our Western Electric Watchmaster Recorder, (see illustration). An automatic chart record of accuracy is included with each Timer.

Repairs are fully guaranteed by us for one year against defective workmanship and material.

Send your Timers to Dep't. F.M. for an estimate. No obligation on your part. Insure shipment to guarantee safe arrival.

JARDUR IMPORT CO., 874 Broadway, New York, N. Y.
Jardur Bezelmeter Aviation Chronographs and Aviation Wrist-Watches
Manufacturers of Jardur Precision Aviation Accessories

SEE MILES AWAY! 5-POWER TELESCOPE

Perfect for spotting planes, ships; watching sporting events, people, birds, etc. Genuine black, lifetime plastic draw tubes with scientific ground 33 mm lens and metal eye piece! Enlarges everything 5 times size! Brings objects 5 times closer; simple, easy to use.

20 DAY FREE TRIAL OFFER

Try for 20 days at our risk! Return if not completely satisfied. SEND NO MONEY. Just pay postman $2.19 plus few cents postage on delivery. Don't wait—production of telescopes may be curtailed as it has been on binoculars. Vogue Telescope Co., 7759 S. Halsted, Dept. R-134, Chicago.

NOW ONLY $15.00

REAL ENGINE VALUE

The G.H.Q. is a miniature gasoline engine that really operates. Over 15,000 sold in the last year. 1/5 H.P. Complete with propeller (or flywheel), fuel, accessories and full instructions. Fully bench tested and ready to run. For boats, planes, midget cars, etc. Send only $1.00. Shipped Collect C.O.D. same day. Send 25c for Catalog of hundreds of hobby items.
Rough Castings Set, including blueprints, only $6.95.
G.H.Q. MOTORS—Dept. PT, 40 E. 21 St., New York

AUTOMOBILE RACING BOOK

Fifth Edition (Revised)

Well Illustrated

Contains 12 Chapters, 77 illustrations dirt track, championship, and midget cars. How to build engines, chassis and bodies. How to speed up Ford V-8 cars and rebuild Ford A and B engines. World's record cars described. Official AAA midget rules and international formula. Order Now—$1.00 postpaid. $1.12 C. O. D. Money back if not satisfied. RAY F. KUNS, Dept. E-46, Madisonville, Cincinnati, Ohio.

AERONAUTICAL ENGINEERING

Course beginning June 15, 1943, can be finished on or before July 1, 1945, in accord with Selective Service Directive. B.S. Degree. Thorough training. Modern wind tunnel. Urgent need has created demand for women as well as men. Courses also in Civil, Electrical, Mechanical, Chemical, Radio Engineering. Special Preparatory Dept. Low tuition. Low living costs. 60th year. Catalog.

TRI-STATE COLLEGE 763 College Ave. Angola — Ind.

"G" LINE FLYING

Sensational - New - Thrilling

GAS POWERED SUPER SPEED PLANES FLOWN UNDER FULL CONTROL
NOT RADIO CONTROLLED
Productod By Patent Pend.

THE BABY SHARK

Newest "G" Line Sensation Designed for all Class A & B Motors, the BABY SHARK flies at tremendous speeds of from 50 to 75 M.P.H. Amazingly Stable in Flight.

COMPLETE KIT, Only $1.98. Postage 25c
Illustrated Descriptive Folders 5c
VICTOR STANZEL & CO. Schulenburg, Dept. P, Texas

You're Helping Some Boy You Know When You GIVE TO THE USO!

INDEX OF Advertisers JUNE 1943

COMPANY	ADVERTISING AGENCY	PAGE NO.
Aero Industries Technical Institute	West-Marquis, Inc.	149
Aeronca Aircraft Corp	Paris & Peart	81
Aeroplane Photo Supply		177
Aeroproducts Division General Motors Corp.	Kircher, Lytle, Helton & Collett, Inc.	97
Aero Services	John H. Riordan Company	87
Aircooled Motor Corp	Spitz & Webb, Advertising	95
Allegheny Ludlum Steel Corporation	Walker & Downing	91
Allison Division of General Motors	Arthur Kudner, Inc.	133
American School of Aircraft Instruments	West-Marquis, Inc.	175
American Technical Society	Reincke-Ellis-Younggreen & Finn, Inc.	170
Anderson Air Activities	Evans Associates, Inc.	99
Atlantic Aviation Institute, Inc.	Broomfield-Podmore Advertising	174
Audel, Publishers	Grant & Wadsworth, Inc.	172
Aviation Service Corp., Ltd.	Stevenson & Scott, Ltd.	160
Beech Aircraft Corp	The McCormick-Armstrong Co.	20
Bell Aircraft Corp	Addison Vars, Inc.	83
Boeing Airplane Co	N. W. Ayer & Son, Inc.	89
Books, Inc.		171
Boots Aircraft Nut Corp	Cecil & Presbrey, Inc.	19
Breeze Corporations, Inc.	Burke Dowling Adams, Inc.	125
Brewster Aeronautical Corp	Burke Dowling Adams, Inc.	141
Brown's		179
Cessna Aircraft Co.	Gardner Advertising Co.	2nd Cover
Champion Spark Plug Co.	Mac Manus, John & Adams, Inc.	136
Chicago School of Aircraft Instruments	Smith, Benson & McClure, Inc.	157
Classified		178
The Cleveland Model & Supply Co.	The Carpenter Adv. Co., Inc.	173
Cleveland Pneumatic Tool Co.	The Bayless-Kerr Co.	128
Consolidated Aircraft Corporation	Young & Rubicam, Inc.	12-13
Continental Motors Corp.	Wallace-Lindeman, Inc.	82
Culver Aircraft Corp.	The McCormick-Armstrong Co.	180
Curtiss-Wright Corp. Airplane Div.	Baldwin & Strachan, Inc.	55
Curtiss-Wright Propeller Div.	Burke Dowling Adams, Inc.	58
Curtiss-Wright Technical Institute	Oscar Nordin Co.	5
Dallas Aviation School & Air College	The Magnolia Advertising	163
Darnell Corp. Ltd.	Henry L. Rhea Advertising	164
Dole Valve Co.	Evans Associates, Inc.	143
Edo Aircraft Corporation	Cowan & Dengler, Inc.	129
Embry-Riddle School of Aviation	John E. Vodicka, Advertising	165
Fairchild Aircraft	Cecil & Presbrey, Inc.	137
Fleetwings, Inc.	The Aitkin-Kynett Co.	114, 115
Funk & Wagnalls Co.	Franklin Spier & Aaron Sussman, Inc.	155, 168, 172
The General Tire & Rubber Co.	D'Arcy Advertising Co.	73
GHQ Motors	Arthur A. Winston, Sales & Adv. Serv.	176
Goodyear Aircraft Corp	Arthur Kudner, Inc.	6-7
Grand Rapids Industries, Inc.	Wallace-Lindeman, Inc.	139
Gulf Oil Corp.	Young & Rubicam, Inc.	10
Gun Model Co.	E. H. Brown, Advertising Agcy.	172
The Hallicrafters, Inc.	Burton Browne, Inc.	142
Hamilton Standard Propellers	Platt-Forbes, Inc.	131
Harley-Davidson Motor Co.	Klau-Van Petersom-Dunlap Associates	154
Harper Bros.	Denhard, Pfeiffer & Wells, Inc.	158
Haskelite Mfg. Corp.	Evans Associates, Inc.	127
Hayes Industries, Inc.	Guy C. Core Company	9
Heath Company	The Paxson Advertising	8
Henry Holt & Company	Franklin Spier and Aaron Sussman, Inc.	162
Indiana Technical College	N. W. Ayer & Son, Inc.	173
Indian Motocycle Co.	Tracy, Kent & Co., Inc.	160
International Correspondence Schools	N. W. Ayer & Son, Inc.	167
Jacobs Aircraft Engine Co.	Alan P. Lyster Advertising	84
Jardur Import Co.		176
Joyce Aviation, Inc.	Blackett-Sample-Hummert, Advertising	75
Kellogg Switchboard & Supply Co.	Evans Associates, Inc.	135
Koh-I-Noor Pencil Co., Inc.	Roeding & Arnold, Inc.	164
Kollsman Aircraft Instruments	Erwin, Wasey & Company, Inc.	69
Kuns, Ray		176
Lear Avia, Inc.	Roy S. Durstine, Inc.	120
Lewis School of Aeronautics	Frank C. Nahser, Inc.	153
M. B. Libman Co.	Julian R. Basel & Associates	154, 168
Lincoln School of Aeronautical Institute	Buchanan-Thomas, Advertising Co.	169
Littelfuse, Inc.	Merrill Symonds Advertising	146
Lyon Metal Products, Inc.	Evans Associates, Inc.	109
McDonnell Aircraft Corp.	D'Arcy Advertising Co.	87
Marman Products Co.	West-Marquis, Inc.	102
Glenn L. Martin & Company	Van Sant, Dugdale & Co., Inc.	93
National Aeronautics Council	Walter E. Thwing, Inc.	147
National Radio Institute	Van Sant, Dugdale & Co., Inc.	179
Nelson Co.	A. N. Baker Advertising Agency, Inc.	173
New England Aircraft School	Vincent-Curtis	144
North American Aviation, Inc.	Batten, Barton, Durstine & Osborn, Inc.	83
Northrop Co., Inc.	J. Walter Thompson Co.	71
Pan-American Navigation Service		177, 179
Parks Air College, Inc.	Oakleigh R. French & Associates	3
Piper Aircraft Corp.	Hutchins Advertising Co., Inc.	67
Plomb Tool Company	Willard B. Gregory & Co.	130
Plane Facts, Inc.	Peck Advertising Agency	175
Pump Engineering Service Corp.	Fuller & Smith & Ross, Inc.	76

(Index of Advertisers Continued on Next Page)

[While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.]

At Deadline

(*Continued from page 8*)

WE ARE not too perturbed about U.S. aircraft production, despite criticism by such personages as Senator Truman. The senator recently blamed the fact that we are not producing aircraft "to capacity" on the Army and Navy for frequent changes in specifications.

First, let's consider our rate of production. At this writing it has exceeded 6,000 planes per month or close to 75,000 a year. If that is an inferior showing, compare it with this recent British statement: ". . . Some time in June . . . Great Britain will be making airplanes at the rate of 35,000 yearly . . ." That's a little more than 2,900 per month. U. S. production right now—with all its faults—is producing twice as much as the British who, in turn, have frequently stated that their aircraft industry some time ago surpassed the aircraft production rate of Germany.

As to the Army and Navy specification changes, that undoubtedly is the best possible situation in the long run. Remember: despite these changes our production already is higher than that of any other country on earth. Remember too, that the main reason Germany is losing the war in the air is because she froze her aircraft types, aiming solely at high-speed production. The American system, whereby faults that show up in battle can be corrected right on the production lines, is by far the wisest method.

* * *

WHY, when there is an airline accident, does the public immediately assume the cause can't possibly be anything but a planted bomb or some other mysterious mid-air explosion. Or, possibly, a bewhiskered Nazi agent committed some other sinister form of sabotage.

Pan American's recent tragedy near Lisbon is a case in point. Otherwise intelligent newspapermen speculated as to whether hidden German machine guns shot down the Clipper as it approached for a landing. Or that someone had tampered with the controls; or advanced various other forms of poppycock.

Somebody once said "Nobody lies like an eye-witness," and we are inclined to go along with this idiom, particularly when we read in the papers an "eye-witness" account of a crash.

The general public persists in such shenanigans. Inevitably, newspaper reporters interview the inevitable eye-witnesses. And inevitably, one or more of those worthies insists he or she saw the ill-fated airplane "explode in mid-air". Or "a wing fell off." All of it, of course, later proves ridiculous.

* * *

PUBLICITY—the public relations business—is getting to be a pretty big thing in aviation these days. This sign-of-the-times item brought it to mind:

One of the leading aircraft manufacturers recently reported to the Government that it (the manufacturer) had paid its public relations counsel $56,927 for the fiscal year 1942. That's roughly $4,743 per month or $156 a day.

* * *

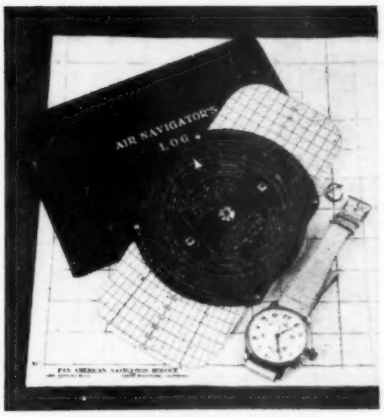
Which isn't exactly ration stamps.—M.K.

END

Index of Advertisers—Continued

COMPANY	ADVERTISING AGENCY	PAGE NO.
RCA Victor Division	Cone & Belding, Inc.	132
Republic Aviation Corp.	Cowan & Dengler, Inc.	123
Roebling's Sons Co., John A.	Rickard and Company, Inc.	77, 85, 94, 126
Romec Pump Company	The White Advertising Co.	107
The Ronald Press Company	Grant & Wadsworth, Inc.	151
Roosevelt Aviation School	Victor A. Smith Advertising	159
Hotel Roosevelt	Kelly, Nason, Inc.	170
Ryan Aeronautical Institute	The Essig Company, Ltd.	174
Ryan Aeronautical Company	The Essig Company, Ltd.	17
Scott Aviation Corporation	Melvin F. Hall Advertising Agcy., Inc.	111
Snap-On Tools Corp.	Scott-Telander Advertising	134
Snyder Aircraft	Smith, Benson & McClure, Inc.	138
Solar Aircraft Company	Logan & Arnold Advertising	14
South Bend Lathe Works	Lamport, Fox & Company	109
Spartan Aircraft Co.	The Potts-Turnbull Company	11
Spartan School of Aeronautics	The Potts-Turnbull Company	78-79
Sperry Gyroscope Co., Inc.	Young & Rubicam, Inc.	116
Standard of California	Batten, Barton, Durstine & Osborn, Inc.	101
Stanzel, Victor & Co.		176
Stewart Technical School	Ruthrauff & Ryan, Inc.	161
The Studebaker Corporation	Roche, Williams & Cunnyngham, Inc.	98
Suncook Mills	Powerad Company	118
Switlik Parachute Company	Maxon Incorporated	113
Tinnerman Products, Inc.	The White Advertising Company	15
Tri-State College	Clem J. Steigmeyer Advertising	176
Vega Aircraft Corp.	Foote, Cone & Belding, Inc.	Back Cover
Vogue Telescope Company	E. H. Brown, Advertising Agency	176
The Waco Aircraft Company	Spencer W. Curtiss, Inc.	121
The Washington Post		16
The Weatherhead Co.	Maxon, Inc.	117
Weems System of Navigation		145
Wittek Mfg. Co.	The Advertising Corporation	18
Wright Engines	Burke Dowling Adams, Inc.	3rd Cover

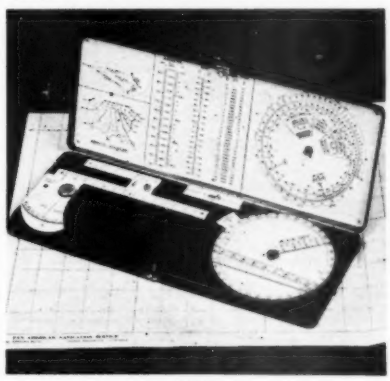
While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.



Important Announcement!

NEW

Dalton E-6B (Army Type) Navigation Computer..$10.00
Air Navigator's Log Book..... 2.00
Longines (large size) Navigation Watch..... 80.00



NEW

Cox & Stevens Dead Reckoning Navigation Computers DeLuxe $35.00
(Used on transoceanic flights)

Pan-American Navigation Service
12021 Ventura Boulevard
NORTH HOLLYWOOD, CALIFORNIA

Buy More War Bonds
Ten per cent is not enough!

PHOTOS

PHOTOS OF ALL THE LATEST ALLIED AND ENEMY AIRCRAFT. (ALSO WORLD WAR 1 AND CRASHES)
REAL PHOTOS, NOT IMITATIONS $1
SET #4 . . . . . FIGHTERS

Thunderbolt	Airacobra	Me. 110
Whirlwind	Lightning	Defiant
Beaufighter	Mosquito	Zero
Hurricane	Destroyer	Spitfire

New 40-page airplane photo catalogue (#18) sent FREE with each set. Catalogue only 10c.
We buy photos and negatives of aircraft. Photos must be postcard size or larger. Negatives all sizes. Cash by return.

AEROPLANE PHOTO SUPPLY
P. O. BOX 195 TORONTO, Canada

Classified Advertising

RATE: 8c PER WORD — FIRST 15 WORDS $1.00

AIRPLANES WANTED

WANTED: Lycoming four or six cylinder engine with reduction gears and one Ranger six cylinder engine. Ardun Mechanical Corporation, 351 W. 52 St., New York City.

GLIDERS

WANTED used primary or secondary glider flight, tested. Bennie Fiet, R.R. 1, Waukon, Iowa.

WANTED: Used one place glider for cash. Will purchase even if slightly damaged providing sale price compensates for repairs. You crate it and I'll pay freight charges. Give full particulars in first letter. Albert Pontarelli, 5530 S. Parkside Ave., Chicago, Ill.

AVIATION SUPPLIES

SCHOOL Material—Twin Row Wasp engines (damaged), Allison Curtiss Electric propellers. Constant speed, retractable landing gears, hydraulic pumps, cylinders, tires, tubes, Continental R-670 engine parts, Lycoming R-680, Wright Cyclone, R-975, spark plugs, Instruments, Fire extinguishers $4.00, flying suit $12.50, $6.00, Helmets $1.50, Leather jackets, Winter flying boots $3.50, gloves $1.50, all used Air Corps material. List free. Marvin A. Northrop Aeroplane Co., Minneapolis, Minnesota.

NEW TIRES: — Factory Stocks — Our Specials 6:00x6 non-skid, 7:00x4, 8:00x4 Smooth 2-ply $8.75, 4-ply $10.75. Tubes $3.25. All sizes stocked 6:50x10, 7:50x10. 8:50x10 Regular. 8:00-10.00 Smooth Contour Tailwheels. 6x2 Solid Tailwheels $1.45. Lowest prices. Immediate deliveries. New reliable Merchandise. Sensenich Propellers. B.G. & Champion Spark Plugs. Storage Batteries. Bob Trader Aero Supply, Municipal Airport, Pittsburgh, Penna.

EQUIPMENT

WANTED: Douglas conversion of Model "A" motor; two 7:00 x 3 airwheels. Joe Cooley, Lawrenceville, Ga.

BOOKS

AIRCRAFT & ENGINE MECHANIC MANUAL—just off the press—contains typical new examinations. Prepare for your rating. Only $3.00, postpaid or C.O.D. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

COMMERCIAL and Private Pilots. New typical "Multiple Choice" examinations are included in "Aeronautical Training" just published; only $3.00 postpaid or C.O.D. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

GROUND Instructors. At last, what you have needed. These three books prepare you for all ratings: "Ground Instructor" a basic text. $3.00. "Ground Instructor Rating," all in multiple choice form, necessary to prepare you for the government test, $3.00. "Air Navigation Note Book" with Dept. of Commerce Navigation Plotter De-Luxe. $4.00. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

PILOTS Meteorology. New text by Lt. Comdr. Halpine; an important book for pilot or Instructor. Only $3.00 postpaid or C.O.D. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

U. S. Coast and Geodetic Navigation Computer. Solves time, speed, distance and drift. With instructions only $3.00. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

FLIGHT Instructor. 1942 edition—with new "Multiple Choice Typical Examinations." Load Factor problems with solutions. Important information you must know. Only $3.00, postpaid or C.O.D. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

RADIO-TELEPHONE Permit. Complete authentic government examinations fully covered in "Radio & Instrument Flying" by Charles A. Zweng. This latest book prepares you for Instrument Rating—necessary for Airline and Ferry Command. Only $4.00, postpaid or C.O.D. Quiz System, 12021 Ventura Blvd., N. Hollywood, Calif.

GROUND Instructors. Enroll now for complete "Ground Courses" in Aviation war defense work. Our graduates now in all branches of government services. Write for "folder." Pan American Navigation Service, 12021 Ventura Blvd., N. Hollywood, Calif.

AIRCRAFT Hydraulic Systems — Attention, students, mechanics, engineers, draftsmen: complete information on design, testing and maintenance of commercial and military hydraulic installations. A specialized branch of aeronautics for you to get into now for only $2.50. Aircraft Specialties, 134 S. Waller Ave., Chicago, Illinois.

BACK dated magazines (foreign, domestic, arts). Used textbooks—Latest books—Booklets. All publishers. Catalogs 10c (refunded). Cicerone's, Dept. C, 863 First Avenue, New York, N. Y.

QUALIFY as Airplane & Engine Mechanic. 1943 texts prepare you for A & E rating (license) exam. Covers all phases required mechanical work, diagrams and latest Civil Air Regulations. Author holds A & E Certificate plus Aeronautical Engineering Degree. Aircraft text $1.25. Engine text $1.25. Combination $2.00. Postpaid or C. O. D. Flight Press, Box 101-A, Edwardsville, Ill.

CAA WRITTENS are no longer a hazard. WTS trainees, pre-flight students, private and commercial candidates and instructors now depend on the simplified explanations, diagrams, exercises, and over 1,000 multiple-choice simulated examination questions, with key, in the Revised Edition of J. H. McLendon's "Aeronautics Ground School Guide." There are separate divisions on Civil Air Regulations, meteorology, aircraft, parachutes, instruments, navigation and engines. $2.50 postpaid. Hemphill's Book Store, Austin, Tex.

500 AVIATION Questions correctly answered—$1.00. Agents wanted. Tuck Publishers, 73 S. Shirley, Pontiac, Mich.

MISCELLANEOUS

PHOTOGRAPHS of "Mosquito," "Thunderbolt," "Destroyers," and 40-page catalogue of latest Allied and enemy fighters and bombers (including Japanese), 25c. Aeroplane Photo Supply, Box 195, Toronto, Canada.

FIGHTING Aircraft of America—At War! Send 25c war stamp for three 9" x 12" sample drawings of Lightning, Avenger, Corsair, and list of others. Henry Clark, 147-28 90th Ave., Jamaica, N. Y.

WORLD War I & II authentic aeroplane souvenirs, small sections of metal wings cut from German Heinkel 2 motored bomber shot down over London, England, in 1940, postpaid 50c. Complete steel cylinder or wing struts from 1918 French Neuport 28, $1.50. Cylinders make wonderful lamp bases; plans free. Magneto gears with attractive stickers United Nations, German wing insignias in colors make swell paper weights, postpaid $1.00. Damaged Curtiss P-40 propeller blades $4.00. German, French, English propeller pieces for souvenirs, 25c postpaid. Send 3c for list including many other interesting items to collectors. Marvin Northrop Aeroplane Company, Minneapolis, Minnesota.

HAND Made Cigars. Off colors 10 and 15 cent Tobaccos. Only 6 cents. Free Catalog Price list. Sidney Ram C-2, 59 West Monroe, Chicago, Ill.

SUPERWAX preserves, waterproofs canvas, rope, leather goods. Waxes skis. Finishes wood. Prevents rust. 1½ lb. cake, $1.00. Circular free. Superwax, Box 1492-F, Milwaukee, Wis.

WARPLANE photographs. Specimen and list (1,000 titles), send 25c. Real Photographs, Ltd., Southport, England.

WANTED—MISCELLANEOUS

CASH in on your Aviation Ideas! National, reputable organization will manufacture and market additional worthwhile lines of aviation parts, gadgets, instruments, accessories, etc., whether patented or not. Exclusive selling rights, outright purchase, or royalty basis, whichever you prefer. Write full particulars for quick action. Box B, % FLYING.

HELP WANTED

AERONAUTICAL Designers, Stress Engineers, Production Engineers, Tool Designers, Inspectors, and Jig Builders: Wanted for permanent key positions in new Aircraft Corporation working on design of advanced light transport and parts contracts. Wooden aircraft experience helpful. Write résumé of experience, education, draft classification, and age to The Strickland Aircraft Corporation, Topeka, Kansas.

TEST Pilot Experienced in operation of 1,000 horsepower, single engine airplane by large Eastern aircraft engine manufacturer. Engineering training desirable but not necessary. Persons employed in war production need not apply. Box C, % FLYING.

SITUATIONS WANTED

YOUNG woman with office experience would like position at airport for June, July and August. Member of "Civil Air Patrol." Florence A. Fryer, 8 Strathallan Pk., Rochester, N. Y.

INSTRUCTION

DRAFTING, Trigonometry, Slide Rule courses. Understandable. Reasonable. Free circular. Inquire Giles, Box 149E, Burbank, Calif.

ACADEMY Preparatory Service. Successful instruction for men who have or seek appointments to the United States Military Academy, Naval Academy, or Coast Guard Academy. Courses on college level cover required subjects as prescribed in official publications and as exemplified in recent examinations. Home study methods assure thorough training at low cost. Resident tutoring if desired. For information write Capt. A. T. Bell, U. S. Army, retired, 119 Franklin Blvd., Merrick, N. Y.

PASS CAA Examinations! Simplified home study course prepares you for written exam for Private Pilot Certificate. All your questions answered. Set your own pace. Rates reasonable. Write today. Wisconsin Aeronautical Institute, 1522 Flett Ave., Racine, Wis.

AVIATION Cadet Preparatory Course for men who want to qualify for training as pilots, bombardiers, and navigators in the Army Air Force. Thorough instruction assures success. Home study $25. Also resident tutoring. For information, write Capt. A. T. Bell, U. S. Army, retired, 119 Franklin Blvd., Merrick, N. Y.

CORRESPONDENCE Courses and self-instruction books, slightly used. Sold. Rented. Exchanged. All Subjects. Satisfaction guaranteed. Cash paid for used courses. Complete details and 84-page illustrated bargain catalog FREE. Write Nelson Company, 500 Sherman, Dept. F237, Chicago.

PATENTS

PATENT Particulars and Blanks, Free: Sterling Buck, F-Hotel Plaza, Washington, D. C.; Government-Registered Patent Attorneys 36 years.

PATENT your Good Ideas! Send me your simple sketch or model. Free confidential advice—literature. Z. Polachek, Registered Patent Attorney-Engineer, 1234 Broadway, New York City.

PATENTS: Low Cost. Book and advice free. L. F. Randolph, Dept. 372, Washington, D. C.

Reply to Box Numbers % FLYING, 540 N. Michigan Ave., Chicago. This does not apply to Box Numbers where city and state are shown.

Altitude and Vision

PAN American *Clipper* captains recently figured out a vision-range formula by which you can deduct how far you can see from any altitude. This formula, of course, can be applied only on days where there is good visibility on a relatively cloudless day. Levelness of the ground must also be considered.

Here is the formula: "Your range of vision is equal to the square root of your altitude multiplied by 1.225 miles." The following table was worked with this formula:

From	1,000 feet you can see	39 miles
From	2,000 feet you can see	55 miles
From	3,000 feet you can see	62 miles
From	4,000 feet you can see	77 miles
From	5,000 feet you can see	82 miles
From	10,000 feet you can see	123 miles
From	15,000 feet you can see	150 miles
From	20,000 feet you can see	173 miles
From	25,000 feet you can see	194 miles

"Aunt Sally's Fleet"

"AUNT SALLY'S FLEET" is the latest addition to the RAF's collection of training gadgets. The fleet, comprised of small, high-speed boats, is built to be bombed. Automatic controls and the engines are amidships under heavy armor plate. These little boats can duplicate the movement of anything from a lumbering battlewagon to a swift motor convoy, thus giving a realistic target to the RAF bomber crews.

Be a RADIO Technician

Learn at Home. Many Make $30, $40, $50 a Week

The Radio repair business is booming due to shortage of new sets. The Government is spending millions for Radio equipment; CIVILIAN Radio technicians and operators are needed by Government in large numbers. Radio training helps win extra rank, extra pay in Army, Navy. Get into Radio quick. Train at home. Free book tells Radio's opportunities, its bright future, how to make $5 to $10 a week extra fixing Radios while learning. Mail coupon.

MR. J. E. SMITH, Dept. 3FY7
National Radio Institute, Washington, D. C.
Mail me your book FREE. (No salesman will call. Write Plainly.)

NAME.....AGE.....

ADDRESS.....

CITY.....STATE.....

BARGAINS

World's Fair Motors, Lights, Valves!

Bank Geared Syn. Motors, 1/75 h.p., 3 ph., B.B. 208 volt, 1800 r.p.m. reduction 96 to 1.....each $11.00
400 Watt Mercury Vapor Lamps with long life daylight bulb and untarnishable Aluminum Reflector, complete with base socket and 220 volt A.C. transformer.....each $13.00
with 110 volt A.C. transformer.....each 16.00
1500 Watt Mazda Spots with unturnishable Aluminum Reflector complete with base and socket.....each $6.00
Also—Asco Electric Solenoid Valves, Mercoid Relays and 2 kw Steam Generators
Used Merchandise
25% with order, Balance C.O.D.
Brown's, 144-15 20 Ave., Whitestone, Long Island

I Learned About Flying . . .

(*Continued from page 66*)

observe the student's judgment, and technique; and determine whether his progress is up to the required standard. To "ride the controls" destroys the student's confidence in his own ability—rarely is it necessary to take over from student.

As I sat back, quite immobile during the first half of the ride, I was greatly tempted at times to take over because this student was showing himself to be on the weak side. But I wanted to give him all the chance that he had coming to him; he might snap out of it.

Now he was clearing his area for that two-turn spin that I had assigned him. Just as he made his entry I thought perhaps it might be a good idea if I were ready to take over—just in case.

I did not have long to wait before my feelings were confirmed—I would be needed to help in this spin recovery. He started into the spin all right; stick all the way back and full rudder. We went around one, two turns and then the recovery—opposite rudder and stick forward. Just as I thought he would be relaxing on that recovery rudder, he snapped the stick back and the spin reversed! I started for the controls but couldn't budge!

My boots had frozen to the floor! One—two turns more! All that mud that I had picked up when on the ground; freezing temperatures aloft; and my motionless position had done the trick—I was stuck! Quickly I released my safety belt and moved out of my seat toward the front of the cockpit. This leverage did the trick. I broke loose and quickly effected a safe recovery, just above the ground! How high? It was approximately—well, you wouldn't believe me. But I assure you, it was too close for comfort.

Let it be known that under similar conditions—wet boots, freezing conditions aloft, and a weak student—I won't be caught napping again.

END

Flight Instructor
New Revised Edition
by CHARLES A. ZWENG
Author of
"Radio & Instrument Flying," Etc.

This important new book, just off the press, will prove invaluable to the Instructor as well as to his student. All maneuvers are fully covered and illustrated. The new "series of eights" and "series of turns" are shown. New features include, "Flight Examiners," and "Methods of Grading." Other new sections cover the new typical "multiple choice" examinations given for "flight instructor rating." Handsomely bound in Blue Leatherette with gold letters. Price $4.00, postpaid or C.O.D.

NEW DEAD RECKONING EQUIPMENT

For Defense of Land, Sea and Air

AIR NAVIGATION TEXT with Dept. of Commerce Navigation Plotter. Necessary for Cross-country flights, and for Commercial and Instrument rating examinations. Difficult radius of action, Off-course and alternate airport problems plotted and solutions given in a simple understandable method similar to the text used in the U. S. Naval Academy, but improved. Book size 14x8½ in handsome red leatherette with gold letters. Plotter contained in patent cover pocket. Combination only $4.00 postpaid or C.O.D.

SOMETHING NEW—AIR NAVIGATOR'S LOG BOOK

At last . . . available to all airmen is our new Air Navigator's Log Book. For the Celestial Air Navigator on trans-oceanic flights—or for all pilots making "dead reckoning" flights cross country, the "Navigator's Log Book" will provide a permanent record of your navigational flights. Handsome blue leatherette with gold letters (full pocket size). Only $2.00 postpaid.

CHARLES A. ZWENG
Formerly Instructor U.S. Army Air Corps
Gives you personal Instruction

OUTSTANDING NEW AVIATION DEFENSE BOOKS

RADIO and INSTRUMENT FLYING: By Charles A. Zweng, Instructor, U. S. Air Corps. New 1941 Edition covering new important material. Written especially to prepare the pilot for government examination for "instrument rating." Radio-Telephone Permit included with Meteorology, Radio-Orientation, let-down, off-course and alternate airport problems. Only $4.00, postpaid.

FLIGHT INSTRUCTOR: A new text covering the scope of the written examination for flight instructor rating. New authentic Multiple Choice questions with answers included, $3.00, postpaid, or C.O.D.

CELESTIAL NAVIGATION—complete equipment consisting of, Air Navigation Note Book and Navigation Plotter, Simplified Celestial Navigation, Air Almanac, Line of Position Book, and Ilynes Star Chart, all 6 items only $11.75 postpaid or C.O.D.

AERONAUTICAL TRAINING. New enlarged 1942 edition. For the first time shows separate sections containing Private Pilot and Commercial Pilot "Multiple Choice Examinations." Makes your government test easy. $3.00 postpaid or C.O.D.

GROUND INSTRUCTOR. Written for the student preparing for "Ground Instructor Rating." Excellent for class work. Covers Navigation, Meteorology, Aircraft and Theory of Flight, Engines and Civil Air Regulations. $3.00 postpaid or C.O.D.

GROUND INSTRUCTOR RATING. Off the press November 1st. Contains "Multiple Choice" examinations on Navigation, Meteorology, Aircraft and Theory of Flight, Engines and CAR. Nomenclature and aviation dictionary in back of book. It's new and different. Something you cannot afford to be without. $3.00 postpaid. Or it may be purchased in combination with "Ground Instructor" for $5.00.

AIRPLANE and ENGINE MECHANICS: Examinations, New authentic Quizz Book now covers the new Multiple Choice examinations fully illustrated with necessary diagrams. Used by Lockheed, Douglas, Northrup, Ryan and outstanding schools. Why fail? Only $3.00 for both examinations, and CAR.

AIR NAVIGATION (Gold Medal Edition) includes meteorology. Just Published. $3.50.

METEOROLOGY FOR PILOTS by Lt. Comdr. Halpine. Only $2.75 postpaid.

NEW E-6B DALTON NAVIGATION COMPUTER, $10.00.

PAN AMERICAN COLLEGE of CELESTIAL AIR NAVIGATION

(AFFILIATE PAN AMERICAN NAVIGATION SERVICE)

offers the student

CELESTIAL AIR NAVIGATION—This important field of Aviation has developed rapidly during the past year. Since the beginning of the second world war it has been apparent to the government that a critical shortage of air navigators existed. Immediately after December 7th, 1941, marking the actual beginning of the world war for the United States, the government began to survey the field and draw on navigation schools for air navigators and instructors. Airlines established Transition Schools for the purpose of practical advanced training. Former students of "Pan American College of Celestial Air Navigation" are now in various quarters of the world. Some are ferrying bombers to England and allied countries; others are instructing in the Army Air Corps or with Transition Schools for advanced training. Never before has navigation of the air offered such opportunities as the present.

THE CELESTIAL COURSE—This course is under the personal supervision of Charles A. Zweng, recognized authority on Air Navigation and former Instructor in the U. S. Army Air Corps.

Air Navigation Equipment, including Aircraft Sextants, is under the technical supervision of Lt. Comdr. P. V. H. Weems, U. S. N. ret., outstanding American and British authority on Celestial Air Navigation, author of "Air Navigation" (Gold Medal Edition) and "Air Navigation" (British Empire Edition).

PAN AMERICAN COLLEGE of CELESTIAL AIR NAVIGATION

12021 Ventura Blvd. North Hollywood, Calif.

THE NEW "LINK" OCTANT

"Bubble type" for aircraft celestial Navigation. Price $262.50.

Equipment Recommended for the Student Beginning Study of Celestial Navigation:

Air Navigation Note Book with Navigation Plotter	$ 4.00
Simplified Celestial Navigation	3.00
American Air Almanac	1.25
Line of Position Book	2.50
Ilynes Star Chart	1.00
	$11.75

PAN-AMERICAN NAVIGATION SERVICE

12021 Ventura Boulevard NORTH HOLLYWOOD, CALIF.

Worth waiting for!

Along with all the dainty things in her *hope chest* go love and dreams and, now and then, a prayer . . . maybe a tear or two when the mail is late . . . but gentle hands keep busy and anxious heart looks forward to that glad day when he'll be home again.

Culver, too, though all its production is going to war, has a *hope chest* in which are plans, designs and amazing developments that will go to make *Culver's* post-war *Victory Models* the most sought after cross-country airplanes for private use. When we can show them to you, you'll agree that they, too, were worth waiting for!

Under Contract to the U.S. Army Air Corps and the U.S. Navy

CULVER
AIRCRAFT CORPORATION

CULVER AIRPORT
WICHITA, KANSAS

COPYRIGHT 1943, CULVER AIRCRAFT CORP.

FREE Packet of "Worth Waiting For" beautifully illustrated postcards.

CULVER AIRCRAFT CORPORATION
Dept. F.
Culver Airport, Wichita, Kansas

— Please send me your FREE PACKET of illustrated postcards.

— I want to be among the first to receive specific information about the *Culver Victory Models* as soon as it can be released.

I (am—am not) a pilot.

Name.....

Address.....

City.....State.....

1194 67 I

PRINTED IN U. S. A.

1943
U. S. A.